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RESEARCH MEMORANDUM

for the

Air Research and Development Command, U. S. Air Force

PRELIMINARY PERFORMANCE DATA OBTAINED IN A FULL-SCALE FREE-JET INVESTIGATION OF A SIDE-INLET SUPERSONIC DIFFUSER

By John M. Farley and Ivan D. Smith

Lewis Flight Propulsion Laboratory
Cleveland, Ohio

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS
WASHINGTON

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FOREWORD

To permit expeditious transmittal of performance data to those concerned, figures and a tabulation of "Preliminary Data" are presented herein. Preliminary Data are test data that have not received the complete analysis and extensive cross-checking normally given a set of NACA data before release.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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SUMMARY

A full-scale free-jet investigation of the performance of several modifications of a side-inlet ram-jet engine diffuser was conducted in an NACA Lewis altitude test chamber. Data were taken over a range of air flows from 60 to 110 pounds per second and a range of inlet temperatures from 860° to 985° R. All data were obtained at a nominal Mach number of 2.75 and an angle of attack of 3°.

Total-pressure-recovery profiles, Mach number profiles, longitudinal wall static pressure distributions and variation of the ratio of average-static to average-total pressure at the diffuser outlet with total-pressure recovery, are presented for the various diffuser modifications.

INTRODUCTION

At request of the U. S. Air Force, a full-scale, free-jet investigation to evaluate and improve the performance of the 48-inch ram-jet engine, designed for use in the Navaho II missile, is being conducted at the NACA Lewis laboratory. The engine diffuser (manufacturer's designation G-26) is a side-inlet type designed for a flight Mach number of 2.75. The supersonic portion is essentially a 216° segment of a single cone Ferri-type diffuser. The internal portion is contoured to bend the air in toward the missile body, and to diffuse it to the 32-inch-diameter diffuser-outlet station.

Early in the investigation, it was found that flow separation occurred and that the diffuser-outlet flow profiles were greatly distorted. This flow distortion resulted in high combustor pressure drops, and in combustion upstream of the flameholding elements.

To determine the best method of improving the diffuser-outlet flow uniformity, the manufacturer initiated an intensive investigation using a 0.15 scale model of the diffuser. The most promising modifications evolved from the scale tests were investigated in the full scale diffuser at NACA. Among the full scale modifications which were investigated in the full scale diffuser are:

(1) A 30 percent blockage screen installed near the diffuser outlet

(2) A combination of the screen and vortex generators

(3) A combination of vortex generators and a half screen, placed across the high velocity side of the duct

(4) Four different arrangements of vortex generators in the diffuser duct

This paper presents the preliminary performance data obtained in the full-scale investigations of these modifications, and in addition, shows the flow distributions obtained with the unmodified diffuser, both with and without instrumentation rakes installed at a station about midway along the diffuser duct.

All data were obtained with free-jet operation at a nominal Mach number of 2.75, and a 3° angle of attack. Data were taken over a range of engine air flows from 60 to 110 pounds per second, and a range of inlet temperatures from 860° to 985° R. Several combustor flame holders were used in the course of the investigation, and diffuser performance data were obtained both cold flow and with the combustor operating. A facility limitation prevented operation of the diffuser in the subcritical range; therefore only supercritical data were obtained.

APPARATUS

Basic diffuser. - An isometric sketch of the basic diffuser is presented in figure 1. Area variations through the duct are shown in figure 2.

Diffuser modifications. - The various diffuser modifications investigated are listed in the following table:

[redacted]

Configuration	Description	Reference for details
Full screen	30 percent blockage screen at missile station 660	Figure 3
V. G. D18C - 55	Three rows of vortex generators on diffuser inner body and one row on cowl	Figures 4 and 5
V. G. D18C - 55 + full screen	Combination of the two previous configurations	Figures 3, 4, and 5
V. G. D18C - 28	Same as D18C - 55 except angles of attack of several vortex generators reversed.	Figure 4
V. G. D18C - 28 + half screen	Screen across high velocity side of duct at missile station 660, in addition to vortex generator configuration D18C-28	Figures 4 and 6
V. G. D18C - 116	Eight rows of vortex generators on diffuser inner body; four rows on cowl.	Figures 4 and 7
V. G. D18C - 116a	Same as D18C-116 except vortex generator spans reduced 19 percent	Figures 4 and 7

Installation. - Installation of the engine in the free-jet test facility is shown in figure 8. The supersonic diffuser inlet was mounted within the Mach cone of the 2.75 Mach number supersonic nozzle. Air bypassed around the engine was diffused to exhaust ambient pressure by means of the jet diffuser. Windows were provided in the plenum between the supersonic nozzle and the supersonic diffuser inlet, to permit observation of the inlet shock pattern by means of a shadowgraph system. (See detail on fig. 8.) Reference 1 gives details of the free-jet facility and the supersonic nozzle flow characteristics.

Instrumentation. - Details of instrumentation used to determine diffuser performance are shown in figures 8 and 9. Station 3' instrumentation was installed only for the full screen configuration runs, because the screen was installed downstream of the diffuser outlet instrumentation station.

PROCEDURE

To obtain the desired diffuser inlet conditions, the inlet total temperature was first set by means of the facility combustion air heaters. The supersonic nozzle inlet total pressure was then adjusted to give the desired air flow. Diffuser pressure recovery was varied by means of a clamshell-type throttle on the exhaust nozzle when the combustor was not operating. With the combustor operating, recovery was varied by changing the engine fuel air ratio.

The nominal inlet conditions, at which data were obtained, are shown in the following table:

Engine air flow, W, lb/sec	Inlet total pressure, P_0, lb/sq ft	Inlet total temperature, T_0, $^{\circ}R$
60	1960	985
80	2620	985
80	2450	860
110	3360	860

The inlet total temperature of 985° R is NACA standard with flight Mach number 2.75 above the tropopause. With an engine air flow of 110 pounds per second, air heater capacity limited the inlet temperature to 860° R. Data were obtained with 80 pounds per second air flow and 860° R inlet temperature, to determine the effect of inlet temperature. Symbols used are defined in appendix A and methods of calculation are shown in appendix B.

PRESENTATION OF RESULTS

Table I is an index to all apparatus and performance figures. Performance data for the various diffuser configurations are presented graphically in figures 10 to 18. Part (a) of each of these figures shows diffuser-outlet pressure recovery profiles for selected diffuser operating points (average total-pressure recovery). Part (b) shows corresponding Mach number profiles. Data in these figures were, in general, obtained with an air flow of about 80 pounds per second and 985° R inlet temperature. These data are also presented in numerical form in tables II to X. With the exception of figure 12, part (c) of each figure shows the diffuser longitudinal static pressure distribution, corresponding to the pressure recovery and Mach number profiles; the static instrumentation was not connected when the data of figure 12 were obtained.

When comparing flow profiles, it is helpful to have a more general plot of diffuser performance available as a guide. To serve this purpose

figures 10(d), 11(d), 12(c), and parts (d) of figures 13 to 18, are presented. These figures show the variation of the ratio of the average static pressure to the average total pressure at the diffuser outlet (p_3 average/P_3 average) with average total-pressure recovery (P_3/P_0) for the various diffuser modifications. For comparison, the curve showing ideal (uniform flow) relation between these parameters is included on each figure. When a supersonic diffuser is operating supercritically at a constant flight Mach number, the relation between Mach number (or static to total-pressure ratio) at any station in the diffuser, and diffuser total pressure recovery, is unique. If flow through the diffuser is badly distorted, the flow area is not being effectively used and, for a given average total-pressure recovery, the average static pressure at any station would be lower than the static pressure for uniform flow. Therefore departure of data from the ideal curve of p_3/P_3 against P_3/P_0 is a qualitative indication of the amount of distortion and a basis for comparison of the various diffuser modifications. The method of calculating ideal relation between these parameters is shown in appendix B.

General Discussion of Diffuser Characteristics

Critical pressure recovery. - When attempts were made to operate the diffuser in the subcritical range, the diffuser normal shock interfered with flow through the jet diffuser, with a resultant breakdown in the nozzle supersonic flow. As a result, operation at the diffuser critical point was extremely difficult and the maximum diffuser pressure recoveries measured with the various diffuser modifications are not necessarily critical values. However, recoveries in the range 0.625 to 0.635 were measured with several configurations, and diffuser wall static pressures indicated that the diffuser was operating very close to the critical point when these data were obtained.

Diffuser supercritical mass-flow ratio. - An air flow calibration of the engine was made using a 25-inch-diameter conical exhaust nozzle. This test showed that over a range of inlet pressures from 1660 to 1340 pounds per square foot absolute, and with an inlet temperature of 950° R (±20°), the engine air flow is given by

$$W = 0.9607 \frac{P_0}{\sqrt{T_3}}$$

Using this equation for weight flow, an inlet Mach number of 2.75, and $\gamma = 1.4$, the diffuser mass-flow ratio (or capture area ratio) was calculated to be 0.98 (see appendix B). This value was verified by calculations based on the position of the oblique shock in relation to the

diffuser lip (see fig. 19). Although the shock position varied slightly, this variation could not be correlated with either inlet conditions or diffuser operating point.

Effect of combustion and flame-holder configuration. - Figures 11(d), 12(c), and part (d) of figures 13 to 18 include data obtained with both cold flow and with the combustor operating. Figures 15(d) and 18(d) include data for two or more flame-holder configurations. No distinction is made between hot and cold flow operation or flame-holder type in these plots but similar plots indicated that these variations had no significant effect on diffuser performace. This was verified by comparisons between pressure recovery profiles.

Effect of inlet conditions. - Data presented in parts (d) of figures 15 to 18 show that when engine air flow (or Reynolds number) is increased, the measured value of p_3/P_3 also increase (total recovery being held constant). This indicates an improvement in flow uniformity. To illustrate this effect of Reynolds number on diffuser outlet profiles, figure 20 is presented. Figure 20(a) compares pressure recovery profiles obtained with air flows of 60 and 108 pounds per second. Both sets of data were obtained with an average total pressure recovery of about 0.554. Figure 20(b) shows the corresponding Mach number profiles.

Lewis Flight Propulsion Laboratory
National Advisory Committee for Aeronautics
Cleveland, Ohio, October 29, 1954

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APPENDIX A

SYMBOLS

The following symbols are used in this report:

A	cross section area, sq ft
g	acceleration due to gravity, 32.2 ft/sec^2
M	Mach number
P	total pressure, lb/sq ft abs
p	static pressure, lb/sq ft abs
R	gas constant, 53.3 (ft-lb)/(lb)($^\circ$R)
T	total temperature, $^\circ$R
t	static temperature, $^\circ$R
W	air flow, lb/sec
γ	ratio of specific heats
ρ	density, lb/cu ft

Subscripts:

s	free stream
0	inlet to supersonic nozzle
1	supersonic diffuser inlet
2	instrumentation station 2
3	diffuser outlet instrumentation station, station 3
3'	instrumentation station behind diffuser screen

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APPENDIX B

CALCULATIONS

1. Diffuser Total-Pressure Recovery

Diffuser total-pressure recovery was taken as the ratio of the average total pressure measured at the diffuser outlet instrumentation station (station 3), to the average total pressure measured at the supersonic nozzle inlet (station 0). Since the pressure tubes at station 3 were placed on centers of equal area, area average rather than mass average values of pressure were obtained. It is also noted that any total-pressure losses occurring in the supersonic nozzle are attributed to the diffuser. When the flow at station 3 was partly supersonic, no corrections were made for shock losses at the total-pressure tubes.

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2. Diffuser-Outlet Mach Number Profiles

Mach numbers were calculated at each station-3 total-pressure tube from the ratio of static to total pressure, using 1.38 as the ratio of specific heats. Method of determining static pressure at each tube is discussed below.

3. Diffuser-Outlet Static Pressure

Pressures obtained from the station 3 stream-static tubes were not reliable. Therefore, average static pressure at the diffuser outlet p_3 was determined by averaging the six station-3 wall static-pressure readings. Stream static pressures for Mach number profile calculations, were determined as follows:

(a) Static pressures at the intersections of the instrumentation rakes and the diffuser wall were determined by plotting the wall static pressures against circumferential location of the six wall static taps.

(b) Static pressure at the center of the duct was assumed to be the average wall static pressure.

(c) Static pressure was assumed to vary linearly along each rake.

[redacted]

4. Supersonic Diffuser Supercritical Mass-Flow Ratio, W/W_s

Mass flow in the stream tube approaching the diffuser inlet is given by:

$$W_s = \rho_s A_1 V_s = \frac{P_s}{Rt_s} A_1 M_s \sqrt{\gamma_s g Rt_s} = \sqrt{\frac{\gamma_s g}{R}} \frac{P_s}{\sqrt{T_s}} A_1 \left[\frac{M_s}{\left(1 + \frac{\gamma_s - 1}{2} M_s^2\right)^{\frac{\gamma_s + 1}{2(\gamma_s - 1)}}} \right]$$

For $M_s = 2.75$, $\gamma_s = 1.4$, and A_1 = geometric diffuser inlet area = 6.151 sq ft

$$W_s = 0.9791 \frac{P_s}{\sqrt{T_s}}$$

Air-flow calibration of the engine showed that engine air flow was given by

$$W = \frac{0.9607\ P_0}{\sqrt{T_3}}$$

But

$$T_3 = T_s \qquad P_0 = P_s$$

Then

$$\frac{W}{W_s} = \frac{0.9607}{0.9791} = 0.981$$

5. Ideal (Uniform Flow) Relation Between the Ratio of Static to Total Pressure and Total-Pressure Recovery

Air flow at the diffuser outlet is given by

$$W_3 = \rho_3 A_3 V_3 = \frac{P_3}{Rt_3} A_3 M_3 \sqrt{\gamma g Rt_3} = \frac{\sqrt{\frac{\gamma g}{R}}\ P_3\ A_3}{\sqrt{T_3}} \left[\frac{M_3}{\left(1 + \frac{\gamma - 1}{2} M_3^2\right)^{\frac{\gamma + 1}{2(\gamma - 1)}}} \right] \quad (1)$$

[redacted]

But an air flow calibration of the engine showed

$$W = \frac{0.9607\ P_0}{\sqrt{T_3}} \tag{2}$$

Equating (1) and (2),

$$\frac{0.9607\ P_0}{\sqrt{T_3}} = \frac{\sqrt{\frac{\gamma g}{R}}\ P_3\ A_3}{\sqrt{T_3}}\left[\frac{M_3}{\left(1 + \frac{\gamma-1}{2} M_3^2\right)^{\frac{\gamma+1}{2(\gamma-1)}}}\right]$$

Transposing,

$$P_3/P_0 = \frac{0.9607}{\sqrt{\frac{\gamma g}{R}}\ A_3}\left[\frac{\left(1 + \frac{\gamma-1}{2} M_3^2\right)^{\frac{\gamma+1}{2(\gamma-1)}}}{M_3}\right] \tag{3}$$

where $\gamma = 1.38$, $A_3 = 4.48$ sq ft and where M_3 is found from

$$p_3/P_3 = \left(1 + \frac{\gamma-1}{2} M_3^2\right)^{\frac{-\gamma}{\gamma-1}} \tag{4}$$

By using equations (3) and (4) the ideal relation between p_3/P_3 and P_3/P_0 may be obtained.

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REFERENCE

1. Seashore, Ferris L., and Hurrel, Herbert G.: Starting and Performance Characteristics of a Large Asymmetric Supersonic Free-Jet Facility. NACA RM E54A19, 1954.

[redacted]

TABLE I. - FIGURE INDEX

(a) Apparatus

Figure	Description
1	Isometric view of diffuser
2	Diffuser area variation
3	Photograph of full screen installation
4	Vortex generator details
5	Photograph of vortex generator (D 18C-55) installation
6	Photograph of half screen installation
7	Photograph of vortex generator (D 18C-116) installation
8	Free-jet test facility and engine installation
9	Details of instrumentation

(b) Diffuser performance

Figure	Configuration	(a)	(b)	(c)	(d)	(e)
10	Original diffuser	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	----------
11	Original diffuser with instrumentation installed at station 2	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	Pressure recovery profiles at station 2
12	Full screen	Pressure recovery profile upstream of screen	Mach number profile upstream of screen	p_3/P_3 against P_3/P_0	Pressure recovery profiles downstream of screen	----------
13	D 18C-55 vortex generator	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	----------
14	D 18C-55 vortex generator and full screen	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	----------
15	D 18C-28 vortex generator	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	----------
16	D 18C-28 vortex generator and half screen	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	----------
17	D 18C-116 vortex generator	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	----------
18	D 18C-116A vortex generator	Pressure recovery profile	Mach number profile	Wall static pressure distribution	p_3/P_3 against P_3/P_0	----------
19	Method of determination of capture area from shock position					
20	Effect of inlet conditions on outlet flow profile					

TABLE II. - PRELIMINARY PERFORMANCE DATA OF THE ORIGINAL DIFFUSER CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, lb/sq ft abs	Inlet total temperature, T_3, $^\circ R$	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a
1	0.507	0.610	2360	958	73.3	0
2	.549	.712	2370	970	73.1	0
3	.578	.775	2360	963	73.1	0
4	.595	.814	2414	959	75.0	0
5	.614	.855	2380	969	73.4	0
6	.630	.872	2365	972	72.9	0

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall static orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.507	A	0.311	0.464	0.566	0.614	0.627	0.616	0.587	0.582	0.579	0.81	0.99	> 1.0	> 1.0	> 1.0	>1.0	>1.0	1.00
		B	.338	.404	.453	.517	.602	.698	.748	.701	.739	.54	.69	.84	.98	>1.0	>1.0	>1.0	>1.0
		C	.327	.486	.608	.734	.704	.662	.666	----	.755	.76	.98	> 1.0	> 1.0	>1.0	>1.0	----	>1.0
		D	.291	.411	.454	.521	.636	.754	.761	.649	.475	.67	.79	.79	> 1.0	>1.0	>1.0	>1.0	.82
		E	.289	.290	.285	.286	.290	.295	.307	.336	.421	.00	.00	.00	.00	.00	.21	.40	.70
		F	.296	.297	.296	.293	.293	.295	.306	.337	.506	.18	.15	.00	.00	.00	.19	.41	.74
2	0.549	A	0.390	0.486	0.518	0.545	0.576	0.599	0.594	0.560	0.528	0.55	0.64	0.70	0.76	0.80	0.79	0.73	0.67
		B	.396	.476	.506	.536	.580	.663	.649	.747	.665	.53	.61	.68	.77	.90	>1.0	>1.0	.91
		C	.395	.584	.669	.739	.776	.779	.664	----	.651	.77	.91	.99	> 1.0	>1.0	>1.0	-----	.89
		D	.386	.556	.627	.682	.725	.725	.671	.594	.551	.73	.86	.93	.99	.99	.92	.80	.72
		E	.388	.386	.383	.383	.382	.383	.386	.396	.431	.00	.00	.00	.00	.00	.00	.15	.39
		F	.399	.423	.421	.403	.406	.400	.397	.403	.547	.34	.33	.21	.23	.17	.14	.20	.41
3	0.578	A	0.452	0.516	0.543	0.569	0.599	0.618	0.614	0.581	0.538	0.43	0.51	0.58	0.64	0.68	0.68	0.62	0.52
		B	.445	.496	.514	.536	.568	.624	.703	.743	.624	.38	.45	.51	.59	.71	.83	.89	.71
		C	.438	.640	.719	.785	.839	.844	.819	----	.632	.76	.87	.95	1.0	1.0	>1.0	---	.73
		D	.448	.601	.661	.698	.718	.703	.649	.583	.529	.68	.67	.83	.86	.84	.76	.63	.50
		E	.449	.449	.445	.445	.445	.446	.448	.453	.476	.00	.00	.00	.00	.00	.00	.11	.29
		F	.457	.486	.487	.473	.476	.469	.464	.462	.577	.32	.33	.25	.27	.24	.20	.19	.31
4	0.595	A	0.487	0.546	0.566	0.585	0.607	0.625	0.634	0.620	0.578	0.39	0.45	0.51	0.56	0.56	0.62	0.60	0.51
		B	.481	.524	.541	.557	.576	.611	.668	.726	.640	.33	.47	.45	.50	.59	.70	.79	.60
		C	.470	.643	.700	.747	.798	.829	.819	----	.636	.68	.77	.83	.90	.93	.91	---	.64
		D	.485	.632	.679	.701	.705	.686	.643	.596	.561	.65	.73	.76	.77	.74	.66	.56	.47
		E	.486	.487	.485	.485	.486	.489	.494	.502	.523	.00	.00	.00	.00	.09	.14	.21	.33
		F	.493	.531	.532	.517	.519	.512	.508	.509	.595	.34	.35	.28	.29	.26	.24	.25	.35
5	0.614	A	0.527	0.556	0.564	0.566	0.567	0.566	0.564	0.556	0.562	0.24	0.29	0.30	0.30	0.31	0.30	0.27	0.30
		B	.523	.572	.591	.605	.620	.643	.678	.716	.679	.36	.42	.46	.50	.55	.62	.68	.62
		C	.519	.654	.699	.729	.753	.759	.750	----	.677	.58	.67	.71	.75	.75	.74	---	.62
		D	.524	----	----	----	----	----	----	----	----	---	---	---	---	---	---	---	---
		E	.525	.528	.529	.533	.538	.546	.556	.567	.589	.10	.12	.15	.19	.24	.29	.33	.41
		F	.534	.551	.555	.545	.557	.561	.565	.576	.586	.26	.28	.23	.29	.30	.32	.36	.44
6	0.630	A	0.551	0.569	0.575	0.578	0.583	0.587	0.588	0.581	0.581	0.20	0.23	0.25	0.28	0.30	0.31	0.28	0.29
		B	.546	.587	.605	.616	.629	.650	.677	.696	.674	.32	.38	.42	.45	.50	.56	.60	.55
		C	.543	.639	.669	.685	.698	.703	.701	----	.671	.49	.55	.59	.61	.62	.61	---	.55
		D	.547	----	----	----	----	----	----	----	----	---	---	---	---	---	---	---	---
		E	.550	.555	.559	.565	.573	.583	.596	.615	.645	.15	.18	.21	.24	.30	.35	.41	.49
		F	.556	.571	.579	.578	.592	.600	.610	.622	.645	.22	.27	.26	.33	.35	.39	.43	.48

TABLE III. - PRELIMINARY PERFORMANCE DATA OF THE ORIGINAL DIFFUSER CONFIGURATION WITH INSTRUMENTATION AT INSTRUMENTATION STATION 2

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, lb/sq ft abs	Inlet total temperature, T_3, °R	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a	Average total pressure at station 2, P_2, lb/sq ft abs
1	0.521	0.658	2299	956	71.4	0	1287
2	.557	.721	2299	952	71.6	0	1283
3	.578	.781	2300	951	71.6	0	1322
4	.600	.819	2287	967	70.6	0	1371
5	.624	.859	2295	977	70.6	0	1433

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall static orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.521	A	0.337	0.381	0.393	0.407	0.429	0.459	0.501	0.563	0.643	0.43	0.48	0.53	.60	.68	.77	.89	1.00
		B	.347	.449	.551	.553	.590	.655	.707	.670	.627	.64	.78	.86	.92	> 1.0	>1.0	>1.0	.98
		C	.356	.495	.566	.660	.751	----	.702	.660	.681	.71	.85	1.00	>1.0	------	>1.0	>1.0	> 1.0
		D	.337	.496	.572	.627	.676	.699	.707	.717	.670	.67	.91	.99	>1.0	> 1.0	>1.0	>1.0	> 1.0
		E	.338	----	.336	.336	----	.337	.358	.387	----	---	.00	.00	------	.00	.28	.44	------
		F	.339	.340	.341	.341	.345	.354	.373	.414	.520	.11	.11	.11	.16	.24	.37	.54	.84
2	0.557	A	0.398	0.499	0.540	0.584	0.614	0.626	0.624	0.612	0.579	0.57	0.67	0.76	0.81	0.83	0.83	0.81	0.75
		B	.398	.463	.484	.502	.524	.566	.650	.734	.697	.48	.55	.59	.65	.73	.87	.98	.94
		C	.404	.601	.684	.756	.800	----	.779	.754	.710	.79	.92	1.0	>1.0	---	>1.0	>1.0	.95
		D	.404	.534	.607	.639	.650	.638	.618	.591	.558	.66	.80	.85	.87	.85	.82	.77	.71
		E	.404	----	.400	.399	----	.399	.408	.420	----	---	.00	.00	---	.00	.17	.27	---
		F	.407	.420	.420	.414	.411	.411	.416	.430	.556	.24	.25	.20	.18	.18	.23	.32	.53
3	0.578	A	0.452	0.507	0.526	0.553	0.584	0.609	0.622	0.621	0.604	0.40	0.46	0.54	0.61	0.67	0.69	0.69	0.66
		B	.446	.508	.527	.540	.556	.590	.656	.726	.676	.43	.49	.53	.57	.64	.76	.86	.94
		C	.438	.619	.682	.732	.778	----	.781	.765	.699	.72	.82	.87	.94	---	.94	.92	.83
		D	.456	.554	.604	.627	.641	.643	.632	.614	.599	.57	.68	.72	.74	.75	.73	.69	.66
		E	.456	----	.459	.462	----	.470	.482	.492	----	---	.11	.15	---	.22	.30	.35	---
		F	.460	.469	.470	.469	.469	.470	.478	.494	.577	.19	.20	.20	.20	.22	.27	.35	.51
4	0.600	A	0.494	0.529	0.543	0.559	0.581	0.600	0.614	0.622	0.628	0.30	0.36	0.42	0.49	0.54	0.57	0.59	0.60
		B	.486	.547	.567	.582	.598	.628	.672	.708	.665	.40	.47	.50	.55	.61	.69	.75	.67
		C	.479	.632	.682	.716	.752	----	.766	.750	.689	.63	.72	.77	.82	---	.84	.81	.72
		D	.496	.577	.616	.635	.649	.659	.664	.660	.646	.50	.59	.63	.65	.67	.68	.67	.64
		E	.495	----	.503	.508	----	.519	.534	.549	----	---	.16	.20	---	.27	.34	.40	---
		F	.499	.507	.508	.510	.514	.519	.531	.548	.600	.17	.18	.20	.23	.26	.32	.39	.52
5	0.624	A	0.538	0.558	0.567	0.579	0.593	0.608	0.621	0.634	0.648	0.22	0.27	0.33	0.38	0.43	0.47	0.50	0.53
		B	.531	.578	.597	.610	.628	.651	.681	.690	.655	.35	.37	.45	.49	.55	.61	.62	.55
		C	.525	.641	.679	.699	.717	----	.712	.707	.667	.55	.62	.65	.68	---	.67	.66	.58
		D	.538	.598	.625	.640	.656	.670	.681	.685	.670	.42	.50	.53	.56	.59	.61	.62	.58
		E	.541	----	.547	.554	----	.568	.585	.604	----	---	.16	.21	---	.29	.36	.42	---
		F	.542	.551	.558	.563	.570	.580	.591	.609	.623	.17	.22	.25	.29	.33	.37	.43	.51

TABLE IV. - PRELIMINARY PERFORMANCE DATA OF THE DIFFUSER FULL SCREEN CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, lb/sq ft abs	Inlet total temperature, T_3, °R	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a	Average total pressure at station 3', P_3', lb/sq ft abs
1	0.548	0.707	2364	863	77.4	0	965
2	.573	.775	2495	964	77.2	.0212	1203
3	.598	.794	2515	980	77.2	.0339	1313
4	.613	.823	2333	842	77.2	.0353	----
5	.634	.849	2510	953	78.1	0	1452

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall static orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, p/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.548	A	0.397	0.432	0.471	0.507	0.555	0.614	0.653	0.657	0.612	0.40	0.54	0.64	0.74	0.84	0.90	0.91	0.84
		B	.431	.429	.460	.492	.546	.640	.767	.747	.724	.14	.36	.49	.65	.83	1.00	.99	.98
		C	.432	.536	.629	.721	.725	.679	.676	.712	.751	.57	.77	.91	.92	.87	.88	.94	1.00
		D	.348	.481	.560	.647	.756	.825	.813	.746	.620	.54	.73	.88	>1.0	>1.0	>1.0	>1.0	.85
		E	.342	.338	.337	.338	.341	.348	.358	.377	.452	.00	.00	.00	.00	.00	.00	.17	.51
		F	.375	.343	.355	.360	.367	.368	.378	.398	.465	.00	.00	.08	.15	.12	.20	.30	.55
2	0.573	A	0.453	0.496	0.519	0.538	0.563	0.606	0.656	0.661	0.592	0.38	0.46	0.52	0.58	0.67	0.77	0.77	0.65
		B	.487	.502	.533	.555	.590	.649	.733	.769	.793	.25	.40	.48	.57	.70	.84	.90	.81
		C	.567	.599	.680	.746	.800	.822	.817	.811	.685	.57	.73	.83	.91	.94	.94	.95	.80
		D	.405	.518	.587	.636	.665	.657	.616	.574	.542	.51	.74	.76	.81	.79	.72	.63	.55
		E	.410	.402	.403	.403	.403	.405	.409	.418	.458	.00	.00	.00	.00	.00	.00	.00	.25
		F	.441	.454	.464	.456	.452	.445	.443	.445	.478	.33	.37	.32	.29	.23	.19	.18	.35
3	0.598	A	0.477	0.517	0.537	0.561	0.591	0.621	0.646	0.645	0.602	0.36	0.43	0.50	0.57	0.64	0.68	0.68	0.60
		B	.491	.496	.510	.525	.550	.590	.657	.733	.680	.18	.28	.34	.44	.55	.69	.81	.74
		C	.507	.632	.709	.765	.823	.846	.826	.794	.685	.59	.73	.81	.89	.92	.90	.87	.74
		D	.453	.601	.672	.713	.741	.739	.689	.631	.587	.54	.68	.75	.80	.80	.73	.63	.55
		E	.453	.451	.453	.452	.453	.455	.459	.468	.506	.09	.08	.00	.00	.00	.00	.11	.33
		F	.471	.591	.500	.498	.497	.492	.487	.487	.518	.31	.35	.33	.32	.29	.25	.24	.37
4	0.613	A	0.502	0.539	0.555	0.570	0.590	0.617	0.648	0.664	0.625	0.32	0.38	0.43	0.49	0.55	0.62	0.65	0.57
		B	.518	.529	.545	.558	.578	.607	.658	.727	.685	.24	.32	.37	.44	.52	.63	.74	.68
		C	.526	.637	.692	.737	.786	.824	.826	.790	.677	.54	.65	.73	.80	.85	.86	.82	.66
		D	.485	.620	.676	.703	.717	.706	.668	.625	.595	.53	.65	.69	.72	.70	.64	.56	.49
		E	.487	.488	.489	.490	.491	.493	.499	.510	.541	.10	.10	.08	.07	.09	.13	.20	.34
		F	.505	.536	.546	.541	.536	.530	.526	.529	.556	.34	.38	.36	.34	.31	.28	.28	.39
5	0.634	A	0.538	0.565	0.579	0.594	0.612	0.635	0.660	0.675	0.662	0.27	0.33	0.38	0.44	0.50	0.55	0.58	0.56
		B	.551	.577	.597	.609	.626	.645	.677	.716	.701	.28	.36	.41	.45	.50	.58	.65	.63
		C	.547	.653	.694	.721	.745	.756	.754	.742	.698	.51	.60	.65	.69	.71	.71	.69	.62
		D	.527	.614	.650	.675	.696	.707	.697	.671	.648	.45	.54	.59	.63	.65	.63	.58	.53
		E	.526	.531	.535	.539	.544	.552	.561	.575	.604	.12	.14	.17	.20	.24	.28	.33	.42
		F	.539	.553	.562	.563	.567	.570	.576	.587	.614	.24	.28	.28	.28	.30	.31	.33	.37

TABLE V. - PRELIMINARY PERFORMANCE DATA OF THE DIFFUSER D 18C-55 VORTEX GENERATOR CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, lb/sq ft abs	Inlet total temperature, T_3, °R	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a
1	0.526	0.721	2515	972	77.5	0.0257
2	.546	.763	1921	973	59.2	.0305
3	.580	.816	1889	968	58.3	.0406
4	.614	.853	2492	981	76.4	0

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.526	A	0.378	0.422	0.440	0.466	0.502	0.541	0.559	0.549	0.522	0.38	0.45	0.54	0.64	0.73	0.77	0.75	0.70
		B	.381	.512	.564	.608	.658	.702	.710	.655	.564	.67	.78	.86	.93	.99	1.00	.93	.78
		C	.367	.544	.620	.679	.680	.624	.566	.540	.537	.77	.90	.98	.98	.90	.80	.75	.74
		D	.382	.495	.552	.587	.596	.587	.570	.542	.514	.65	.77	.83	.84	.83	.80	.75	.68
		E	.382	.398	.418	.452	.478	.498	.507	.505	.496	.25	.37	.50	.59	.64	.66	.66	.64
		F	.386	.385	.384	.385	.387	.392	.402	.423	.471	.10	.09	.11	.15	.20	.28	.40	.57
2	0.546	A	0.418	0.468	0.487	0.509	0.539	0.570	0.589	0.586	0.550	0.39	0.46	0.53	0.61	0.68	0.72	0.72	0.64
		B	.414	.518	.555	.585	.622	.671	.704	.663	.577	.57	.66	.72	.79	.86	.90	.85	.70
		C	.404	.569	.636	.691	.696	.648	.590	.554	.546	.71	.83	.90	.91	.84	.60	.51	.48
		D	.418	.520	.566	.596	.608	.599	.578	.545	.527	.60	.70	.75	.77	.76	.71	.64	.60
		E	.421	.446	.474	.503	.516	.518	.515	.510	.510	.30	.43	.52	.56	.56	.56	.55	.55
		F	.425	.427	.428	.429	.432	.437	.448	.468	.504	.10	.13	.15	.19	.23	.31	.53	.40
3	0.580	A	0.474	0.507	0.522	0.539	0.565	0.601	0.637	0.640	0.578	0.29	0.36	0.42	0.50	0.59	0.66	0.67	0.54
		B	.474	.591	.633	.661	.680	.690	.685	.648	.585	.57	.66	.71	.74	.76	.75	.69	.56
		C	.462	.605	.651	.678	.676	.640	.594	.561	.550	.63	.71	.76	.75	.69	.60	.51	.48
		D	.472	.576	.615	.626	.624	.612	.585	.551	.531	.56	.64	.66	.66	.63	.57	.48	.42
		E	.477	.502	.530	.555	.559	.554	.546	.534	.527	.28	.40	.48	.50	.48	.46	.42	.40
		F	.481	.489	.493	.496	.503	.511	.519	.526	.537	.17	.21	.24	.28	.32	.36	.39	.43
4	0.614	A	0.524	0.560	0.571	0.586	0.610	0.637	0.659	0.654	0.622	0.29	0.34	0.39	0.46	0.53	0.58	0.57	0.50
		B	.521	.646	.685	.699	.702	.691	.670	.643	.623	.56	.64	.66	.66	.65	.61	.55	.51
		C	.512	.619	.646	.650	.642	.632	.628	.627	.624	.52	.58	.58	.57	.54	.53	.52	.51
		D	.524	.598	.629	.642	.651	.659	.665	.660	.628	.46	.54	.56	.58	.59	.61	.59	.52
		E	.528	.535	.551	.567	.576	.577	.577	.580	.599	.11	.24	.33	.37	.37	.37	.39	.45
		F	.531	.536	.540	.544	.550	.554	.564	.576	.599	.13	.17	.20	.24	.27	.31	.36	.44

TABLE VI. - PRELIMINARY PERFORMANCE DATA OF THE DIFFUSER D 18C-55 VORTEX GENERATOR AND FULL SCREEN CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, $\frac{lb}{sq\ ft\ abs}$	Inlet total temperature, T_3, ^oR	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a
1	0.560	0.802	2368	842	78.4	0.0202
2	.581	.829	2352	854	77.3	.0233
3	.598	.847	2357	838	78.2	.0281
4	.612	.858	1870	968	57.8	.0360

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.560	A	0.446	0.477	0.493	0.510	0.533	0.561	0.593	0.611	0.580	0.35	0.41	0.47	0.53	0.60	0.66	0.70	0.63
		B	.470	.483	.510	.531	.566	.618	.684	.686	.589	.28	.39	.47	.57	.68	.79	.80	.64
		C	.468	.564	.622	.676	.707	.688	.640	.588	.553	.52	.65	.75	.80	.78	.71	.62	.55
		D	.452	.536	.580	.611	.623	.614	.590	.555	.536	.48	.59	.66	.69	.67	.63	.55	.47
		E	.425	.509	.549	.561	.554	.540	.527	.519	.526	.47	.59	.61	.58	.55	.51	.48	.49
		F	.434	.442	.447	.452	.461	.474	.490	.504	.535	.24	.25	.28	.32	.36	.42	.45	.53
2	0.581	A	0.482	0.508	0.525	0.543	0.569	0.601	0.634	0.641	0.584	0.32	0.38	0.44	0.52	0.59	0.66	0.66	0.54
		B	.509	.576	.614	.639	.666	.685	.687	.654	.592	.46	.56	.62	.67	.70	.71	.66	.55
		C	.487	.598	.642	.667	.669	.639	.595	.563	.555	.52	.62	.67	.67	.62	.53	.46	.45
		D	.478	.581	.623	.635	.629	.612	.577	.543	.531	.45	.62	.65	.63	.60	.52	.42	.38
		E	.461	.527	.564	.583	.580	.565	.549	.534	.527	.41	.52	.56	.55	.51	.46	.41	.38
		F	.472	.483	.488	.493	.501	.508	.516	.523	.538	.25	.27	.29	.32	.34	.37	.38	.42
3	0.598	A	0.514	0.526	0.540	0.555	0.577	0.605	0.638	0.656	0.610	0.25	0.32	0.38	0.45	0.52	0.59	0.63	0.53
		B	.536	.626	.675	.703	.731	.738	.714	.662	.602	.51	.61	.67	.72	.73	.70	.62	.50
		C	.509	.628	.671	.688	.691	.671	.639	.603	.577	.51	.61	.65	.65	.62	.56	.49	.43
		D	.492	.586	.610	.607	.604	.596	.584	.568	.557	.50	.55	.55	.53	.51	.48	.43	.39
		E	.486	.501	.510	.520	.526	.527	.528	.531	.552	.20	.26	.30	.32	.32	.30	.31	.38
		F	.500	.507	.518	.529	.544	.561	.579	.593	.586	.23	.29	.33	.38	.43	.48	.51	.48
4	0.612	A	0.531	0.556	0.570	0.586	0.604	0.627	0.648	0.648	0.613	0.30	0.36	0.41	0.46	0.52	0.57	0.56	0.48
		B	.548	.641	.685	.703	.707	.696	.669	.636	.607	.50	.60	.63	.64	.63	.48	.52	.45
		C	.526	.624	.661	.670	.666	.655	.641	.627	.606	.47	.55	.58	.57	.55	.53	.50	.45
		D	.516	.594	.625	.637	.641	.645	.643	.632	.603	.45	.52	.55	.56	.57	.56	.53	.46
		E	.508	.528	.542	.554	.560	.561	.562	.568	.587	.23	.30	.34	.35	.35	.35	.37	.42
		F	.520	.528	.534	.541	.550	.559	.572	.586	.597	.22	.24	.28	.31	.34	.38	.42	.44

TABLE VII. - PRELIMINARY PERFORMANCE DATA OF THE DIFFUSER D 18C-28 VORTEX GENERATOR CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, $\frac{lb}{sq\ ft\ abs}$	Inlet total temperature, T_3, ^oR	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a
1	0.501	0.599	2521	938	79.1	0
2	.547	.786	2527	949	78.8	
3	.579	.808	2487	953	77.4	
4	.594	.824	1895	979	58.2	.0340
5	.617	.852	1872	942	58.6	0

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall static orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.501	A	0.311	0.382	0.405	0.440	0.481	0.536	0.546	0.539	0.601	0.62	0.69	.78	.86	.96	.98	.97	>1.0
		B	.333	.388	.435	.508	.616	.689	.683	.628	.648	.51	.67	.84	>1.0	>1.0	>1.0	1.0	>1.0
		C	.311	.438	.536	.604	.564	.561	.614	.671	.727	.68	.89	1.00	.95	.95	>1.0	1.0	>1.0
		D	.278	.416	.555	.680	.698	.681	.673	.703	.755	.74	1.0	>1.0	>1.0	>1.0	>1.0	1.0	>1.0
		E	.280	.281	.281	.291	.314	.357	.409	.467	.598	.10	.05	.22	.39	.58	.73	.86	>1.0
		F	.288	.283	.279	.279	.283	.290	.309	.355	.532	.05	.00	.00	.00	.10	.30	.54	.96
2	0.547	A	0.438	0.485	0.491	0.494	0.499	0.507	0.516	0.533	0.592	0.39	0.41	0.43	0.45	0.48	0.51	0.56	0.69
		B	.426	.488	.501	.519	.552	.600	.644	.629	.628	.43	.48	.53	.61	.71	.71	.77	.76
		C	.412	.549	.591	.612	.621	.635	.657	.665	.676	.64	.73	.76	.77	.79	.82	.83	.84
		D	.427	.553	.585	.576	.565	.566	.585	.627	.672	.65	.71	.69	.67	.67	.70	.77	.84
		E	.437	.458	.475	.491	.502	.512	.523	.540	.595	.30	.38	.44	.48	.51	.54	.58	.70
		F	.439	.436	.436	.436	.438	.443	.454	.480	.565	.00	.00	.04	.10	.15	.26	.39	.64
3	0.579	A	0.472	0.520	0.537	0.559	0.580	0.586	0.568	0.550	0.574	0.37	0.43	0.50	0.55	0.57	0.53	0.51	0.55
		B	.464	.603	.637	.646	.655	.666	.670	.658	.634	.62	.69	.70	.72	.73	.74	.72	.68
		C	.453	.580	.613	.628	.641	.652	.659	.663	.666	.60	.66	.69	.71	.73	.74	.74	.74
		D	.469	.577	.610	.615	.616	.622	.632	.643	.642	.58	.65	.66	.66	.67	.68	.70	.70
		E	.473	.481	.493	.508	.519	.529	.537	.549	.582	.18	.26	.34	.38	.42	.42	.48	.57
		F	.475	.472	.471	.470	.470	.473	.478	.491	.545	.00	.00	.00	.00	.07	.14	.25	.47
4	0.594	A	0.494	0.531	0.545	0.565	0.587	0.603	0.598	0.584	0.597	0.32	0.38	0.45	0.51	0.55	0.54	0.51	0.55
		B	.489	.607	.640	.646	.656	.669	.678	.662	.646	.57	.64	.65	.67	.69	.69	.68	.65
		C	.476	.574	.605	.619	.635	.650	.661	.670	.677	.52	.59	.62	.65	.67	.69	.70	.71
		D	.489	.585	.621	.633	.635	.641	.651	.663	.650	.54	.62	.64	.65	.66	.67	.69	.66
		E	.493	.499	.513	.528	.539	.549	.557	.569	.600	.17	.26	.34	.38	.42	.44	.48	.56
		F	.496	.492	.492	.492	.494	.496	.503	.517	.567	.00	.00	.04	.09	.13	.19	.28	.47
5	0.617	A	0.529	0.562	0.574	0.589	0.609	0.626	0.630	0.628	0.631	0.29	0.34	0.39	0.45	0.50	0.51	0.51	0.52
		B	.527	.622	.652	.664	.674	.678	.674	.663	.654	.50	.56	.59	.61	.62	.61	.59	.57
		C	.516	.631	.668	.679	.673	.656	.641	.632	.642	.54	.61	.63	.62	.59	.55	.53	.55
		D	.522	.582	.607	.613	.611	.609	.609	.612	.636	.42	.49	.50	.50	.49	.48	.49	.54
		E	.529	.561	.593	.616	.626	.628	.630	.637	.640	.32	.43	.49	.51	.52	.52	.54	.54
		F	.532	.529	.531	.532	.534	.540	.550	.570	.619	.00	.07	.10	.13	.18	.25	.34	.49

TABLE VIII. - PRELIMINARY PERFORMANCE DATA OF THE DIFFUSER D 18C-28 VORTEX GENERATOR AND HALF SCREEN CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, lb/sq ft abs	Inlet total temperature, T_3, °R	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a
1	0.520	0.733	2499	973	77.0	0
2	.546	.803	2526	967	78.0	0
3	.577	.832	2501	978	76.9	.0476
4	.598	.847	2348	848	77.5	.0506
5	.622	.862	2543	979	78.1	0

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.520	A	0.395	0.375	0.400	0.440	0.471	0.493	0.493	0.501	0.579	0.06	0.31	0.49	0.58	0.64	0.63	0.65	0.81
		B	.437	.461	.514	.550	.603	.672	.691	.634	.619	.37	.56	.65	.77	.88	.92	.85	.85
		C	.414	.486	.559	.585	.574	.580	.630	.674	.712	.44	.65	.71	.70	.72	.82	.90	.88
		D	.356	.518	.609	.614	.577	.561	.575	.635	.747	.68	.85	.86	.79	.76	.79	.89	>1.0
		E	.330	.368	.383	.411	.449	.487	.507	.530	.632	.33	.40	.50	.61	.69	.73	.76	.90
		F	.356	.311	.315	.328	.343	.362	.392	.446	.564	.00	.00	.00	.00	.20	.37	.55	.79
2	0.546	A	0.448	0.474	0.490	0.508	0.522	0.535	0.545	0.572	0.620	0.37	0.42	0.48	0.52	0.55	0.58	0.64	0.73
		B	.468	.482	.506	.526	.568	.607	.670	.671	.643	.26	.38	.45	.57	.66	.78	.79	.76
		C	.451	.536	.573	.590	.596	.612	.641	.654	.681	.48	.58	.62	.64	.68	.74	.76	.82
		D	.424	.541	.578	.568	.551	.544	.549	.583	.686	.56	.65	.62	.59	.57	.58	.66	.83
		E	.413	.454	.468	.477	.486	.500	.520	.553	.641	.36	.41	.44	.46	.50	.55	.62	.77
		F	.423	.418	.419	.421	.426	.435	.454	.497	.605	.04	.04	.04	.11	.20	.30	.46	.71
3	0.577	A	0.489	0.518	0.535	0.554	0.571	0.581	0.573	0.567	0.615	0.34	0.40	0.46	0.51	0.54	0.52	0.50	0.62
		B	.512	.580	.614	.624	.636	.649	.658	.646	.650	.46	.55	.57	.61	.64	.66	.65	.67
		C	.486	.568	.600	.610	.618	.630	.645	.661	.686	.43	.52	.55	.57	.60	.64	.68	.73
		D	.466	.563	.592	.589	.581	.578	.589	.613	.663	.50	.58	.57	.55	.54	.56	.61	.70
		E	.460	.494	.513	.528	.537	.544	.559	.582	.630	.31	.39	.43	.46	.47	.51	.56	.65
		F	.468	.464	.465	.465	.467	.473	.485	.513	.593	.08	.07	.03	.06	.13	.22	.35	.57
4	0.598	A	0.518	0.545	0.561	0.578	0.600	0.621	0.629	0.625	0.635	0.30	0.37	0.42	0.48	0.54	0.56	0.55	0.57
		B	.532	.616	.651	.658	.662	.669	.676	.675	.665	.47	.56	.58	.59	.61	.63	.63	.61
		C	.509	.572	.596	.606	.614	.626	.640	.655	.674	.35	.44	.47	.49	.52	.56	.60	.64
		D	.495	.589	.625	.637	.637	.636	.641	.652	.664	.48	.57	.59	.59	.59	.60	.61	.63
		E	.491	.519	.536	.552	.564	.573	.583	.599	.634	.26	.34	.39	.42	.45	.47	.51	.58
		F	.500	.500	.502	.504	.507	.511	.520	.542	.605	.13	.13	.13	.15	.18	.23	.33	.51
5	0.622	A	0.545	0.569	0.582	0.599	0.621	0.643	0.655	0.656	0.659	0.28	0.33	0.39	0.46	0.51	0.54	0.54	0.55
		B	.557	.639	.674	.682	.682	.680	.678	.678	.668	.46	.55	.57	.57	.57	.58	.58	.57
		C	.535	.617	.644	.648	.642	.635	.632	.637	.655	.42	.49	.50	.49	.48	.48	.49	.54
		D	.525	.588	.610	.612	.610	.608	.610	.619	.644	.39	.45	.46	.45	.45	.45	.47	.53
		E	.523	.573	.597	.615	.623	.630	.639	.648	.657	.37	.84	.48	.50	.52	.53	.55	.56
		F	.532	.532	.535	.537	.541	.548	.562	.590	.643	.14	.16	.16	.19	.22	.29	.39	.53

TABLE IX. - PRELIMINARY PERFORMANCE DATA OF THE DIFFUSER D 18C-116 VORTEX GENERATOR CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, lb/sq ft abs	Inlet total temperature, T_3, °R	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a
1	0.500	0.652	2497	964	77.3	0
2	.547	.776	2504	981	76.8	0
3	.579	.827	2500	982	76.6	.0472
4	.594	.834	2506	979	77.0	0
5	.613	.862	2507	979	77.0	0
6	.635	.870	2488	974	76.6	0

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall static orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.500	A	0.328	0.491	0.611	0.618	0.554	0.521	0.540	0.553	0.498	0.74	0.96	0.96	0.88	0.82	0.86	0.89	0.80
		B	.330	.451	.518	.585	.630	.646	.655	.601	.508	.69	.84	.95	>1.0	>1.0	>1.0	.98	.83
		C	.310	.421	.499	.587	.584	.559	.542	.540	.526	.64	.82	.98	.97	.93	.90	.90	.87
		D	.302	.298	.295	.293	.294	.295	.304	.345	.488	.00	.00	.00	.00	.00	.00	.36	.80
		E	.330	.366	.404	.449	.462	.409	.351	.343	.454	.50	.63	.75	.76	.63	.39	.32	.73
		F	.356	.420	.500	.620	.708	.736	.711	.625	.533	.56	.77	.98	>1.0	>1.0	>1.0	1.00	.87
2	0.547	A	0.424	0.568	0.606	0.615	0.615	0.597	0.573	0.549	0.516	0.64	0.72	0.74	0.74	0.70	0.66	0.61	0.52
		B	.425	.558	.609	.622	.619	.620	.626	.611	.539	.64	.74	.76	.76	.78	.77	.75	.60
		C	.418	.505	.544	.569	.579	.572	.566	.570	.543	.52	.62	.67	.69	.68	.66	.67	.61
		D	.416	----	.433	.429	.427	.436	.471	.531	.541	---	.23	.20	.17	.24	.41	.60	.61
		E	.425	.472	.490	.501	.502	.501	.509	.533	.535	.42	.48	.51	.52	.51	.53	.59	.59
		F	.439	.480	.503	.523	.582	.637	.660	.598	.521	.39	.48	.56	.68	.67	.65	.71	.82
3	0.579	A	0.480	0.590	0.632	0.653	0.653	0.634	0.613	0.595	0.585	0.55	0.64	0.68	0.68	0.65	0.60	0.57	0.55
		B	.479	.581	.614	.616	.609	.603	.601	.604	.597	.54	.61	.62	.61	.59	.59	.59	.58
		C	.471	.563	.582	.570	.558	.555	.566	.579	.579	.50	.55	.52	.49	.48	.51	.54	.54
		D	.473	.487	.506	.528	.551	.570	.578	.570	.552	.23	.33	.41	.48	.53	.55	.53	.47
		E	.480	.500	.514	.529	.543	.550	.552	.562	.564	.28	.34	.40	.44	.46	.47	.49	.50
		F	.490	.511	.525	.541	.574	.627	.691	.673	.580	.29	.35	.41	.51	.63	.74	.72	.54
4	0.594	A	0.498	0.606	0.646	0.671	0.675	0.660	0.636	0.611	0.591	0.53	0.61	0.66	0.67	0.65	0.60	0.55	0.51
		B	.494	.603	.637	.644	.637	.627	.622	.619	.609	.54	.61	.62	.61	.59	.58	.57	.55
		C	.489	.548	.561	.559	.558	.565	.578	.597	.604	.40	.44	.43	.43	.45	.48	.53	.55
		D	.490	----	.538	.563	.585	.597	.596	.582	.573	---	.37	.45	.51	.54	.53	.50	.47
		E	.496	.525	.540	.555	.566	.571	.571	.575	.572	.31	.37	.42	.45	.46	.46	.47	.46
		F	.507	.526	.540	.558	.590	.639	.686	.659	.582	.26	.33	.40	.50	.61	.69	.65	.48
5	0.613	A	0.534	0.583	0.599	0.615	0.630	0.635	0.631	0.616	0.598	0.35	0.41	0.45	0.49	0.51	0.50	0.47	0.42
		B	.529	.625	.654	.655	.646	.639	.637	.632	.610	.49	.56	.56	.54	.53	.52	.51	.46
		C	.519	.603	.624	.625	.620	.617	.623	.635	.620	.46	.51	.51	.50	.49	.50	.53	.49
		D	.523	----	.572	.582	.594	.607	.616	.617	.606	---	.37	.40	.43	.47	.49	.49	.45
		E	.530	.572	.590	.605	.617	.620	.614	.609	.599	.35	.41	.46	.48	.49	.47	.46	.43
		F	.537	.561	.577	.594	.617	.639	.647	.626	.596	.27	.34	.40	.47	.52	.54	.50	.33
6	0.636	A	0.557	0.589	0.600	0.607	0.616	0.618	0.614	0.608	0.604	0.29	0.34	0.37	0.40	0.40	0.41	0.38	0.37
		B	.552	.648	.679	.684	.682	.676	.666	.649	.620	.49	.56	.57	.57	.56	.54	.50	.42
		C	.543	.638	.667	.674	.670	.659	.650	.647	.634	.49	.55	.57	.56	.53	.51	.50	.46
		D	.547	.595	.613	.619	.619	.624	.637	.643	.625	.37	.43	.44	.44	.45	.48	.49	.44
		E	.555	.584	.600	.615	.629	.640	.642	.635	.616	.31	.37	.42	.46	.48	.49	.47	.42
		F	.560	.584	.599	.611	.623	.630	.632	.623	.605	.28	.34	.39	.42	.44	.45	.43	.38

TABLE X. - PRELIMINARY DATA OF THE DIFFUSER D 18C-116A VORTEX GENERATOR CONFIGURATION

(a) Average values

Run	Diffuser total pressure recovery, P_3/P_0	Ratio of diffuser outlet static to total pressure, p_3/P_3	Inlet total pressure, P_0, $\frac{lb}{sq\ ft\ abs}$	Inlet total temperature, T_3, °R	Diffuser air flow, W_a, lb/sec	Over-all fuel air ratio, f/a
1	0.507	0.714	2610	972	80.4	0
2	.546	.785	2589	968	79.9	0
3	.576	.811	2600	971	80.2	.0399
4	.594	.826	2606	972	80.3	0
5	.614	.862	2602	972	80.2	0
6	.629	.875	2570	976	79.0	0

(b) Diffuser outlet profile data

Run	Average diffuser outlet total pressure recovery, P_3/P_0	Total pressure rake or wall static orifice	Wall static to inlet total pressure ratio, p/P_0	Diffuser outlet total pressure recovery ratios, P/P_0								Diffuser outlet Mach number, M							
				Tube								Tube							
				1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	0.507	A	0.363	0.509	0.591	0.583	0.523	0.503	0.524	0.552	0.506	0.69	0.85	0.84	0.73	0.69	0.74	0.80	0.71
		B	.362	.432	.480	.529	-----	.607	.631	.604	.493	.52	.65	.76	----	.90	.93	.90	.69
		C	.353	.468	.524	.559	.541	.515	.518	.536	.498	.64	.77	.83	.80	.75	.75	.79	.70
		D	.351	-----	.348	.358	.378	.404	.436	.478	-----	----	.00	.16	.32	.44	.55	.67	----
		E	.360	.373	.393	.421	.440	.426	.393	.401	.504	.29	.41	.51	.57	.52	.38	.43	.72
		F	.379	.441	.493	.553	.622	.692	.717	.679	.548	.51	.66	.79	.91	>1.0	>1.0	.99	.80
2	0.546	A	0.429	0.510	0.547	0.592	0.641	0.657	0.641	0.599	0.540	0.49	0.59	0.68	0.77	0.80	0.78	0.70	0.58
		B	.428	.554	.604	.616	-----	.623	.633	.621	.538	.62	.73	.74	----	.76	.77	.75	.58
		C	.424	.548	.586	.578	.559	.547	.547	.543	.518	.62	.69	.68	.63	.61	.61	.60	.53
		D	.422	----	.456	.460	.475	.509	.552	.567	----	---	.33	.35	.40	.52	.62	.66	---
		E	.427	.432	.447	.478	.512	.548	.563	----	.565	.17	.28	.42	.53	.62	.65	----	.65
		F	.439	.440	.444	.452	.469	.509	.586	.655	.572	.18	.21	.27	.35	.50	.69	.80	.66
3	0.576	A	0.470	0.568	0.614	0.655	0.673	0.669	0.659	0.641	0.604	0.52	0.63	0.71	0.74	0.73	0.72	0.69	0.62
		B	.467	.584	.620	.623	----	.599	.596	.600	.595	.58	.66	.66	---	.62	.61	.62	.60
		C	.460	.553	.571	.562	.552	.552	.564	.577	.573	.52	.52	.54	.51	.51	.54	.57	.55
		D	.465	----	.535	.570	.591	.594	.580	.557	----	---	.47	.56	.61	.61	.58	.52	---
		E	.468	.481	.493	.509	.524	.539	.552	.570	.572	.22	.29	.36	.42	.46	.50	.55	.55
		F	.478	.484	.492	.499	.511	.539	.602	.678	.611	.21	.26	.30	.35	.46	.61	.75	.63
4	0.594	A	0.494	0.587	0.626	0.657	0.677	0.683	0.684	0.669	0.623	0.49	0.58	0.64	0.68	0.70	0.70	0.68	0.59
		B	.492	.599	.634	.636	----	.622	.626	.638	.616	.54	.62	.62	----	.59	.60	.63	.58
		C	.485	.546	.561	.563	.566	.577	.594	.608	.594	.42	.46	.46	.47	.50	.54	.57	.53
		D	.488	----	.578	.605	.617	.614	.599	.576	----	---	.61	.57	.60	.59	.55	.49	---
		E	.492	.506	.519	.539	.559	.583	.601	.612	.594	.23	.30	.38	.44	.51	.55	.57	.53
		F	.501	.501	.505	.510	.521	.548	.600	.669	.632	.13	.17	.21	.28	.39	.54	.68	.61
5	0.614	A	0.535	0.586	0.602	0.619	0.637	0.645	0.644	0.633	0.609	0.36	0.42	0.47	0.51	0.53	0.53	0.50	0.45
		B	.531	.632	.663	.663	-----	.646	.647	.645	.616	.51	.58	.58	----	.54	.55	.54	.48
		C	.523	.616	.640	.640	.634	.629	.632	.633	.613	.49	.54	.54	.53	.51	.52	.52	.47
		D	.526	----	.585	.593	.600	.607	.609	.604	----	---	.41	.43	.45	.46	.47	.45	---
		E	.532	.561	.578	.596	.610	.618	.614	.605	.594	.31	.37	.43	.47	.49	.48	.45	.41
		F	.540	.550	.559	.571	.585	.605	.628	.633	.602	.22	.26	.32	.37	.43	.50	.51	.43
6	0.629	A	0.552	0.580	0.589	0.597	0.609	0.615	0.616	0.612	0.610	0.26	0.31	0.34	0.38	0.40	0.40	0.40	0.40
		B	.550	.636	.668	.678	-----	.674	.663	.647	.620	.47	.54	.57	----	.55	.53	.50	.43
		C	.540	.631	.656	.660	.655	.644	.633	.629	.622	.47	.53	.54	.53	.50	.47	.46	.44
		D	.545	----	.608	.612	.617	.628	.644	.646	----	---	.42	.43	.44	.47	.50	.39	---
		E	.552	.574	.590	.608	.628	.649	.655	.644	.621	.28	.34	.40	.46	.50	.52	.50	.43
		F	.557	.574	.587	.600	.615	.628	.634	.629	.611	.24	.30	.35	.40	.44	.46	.45	.40

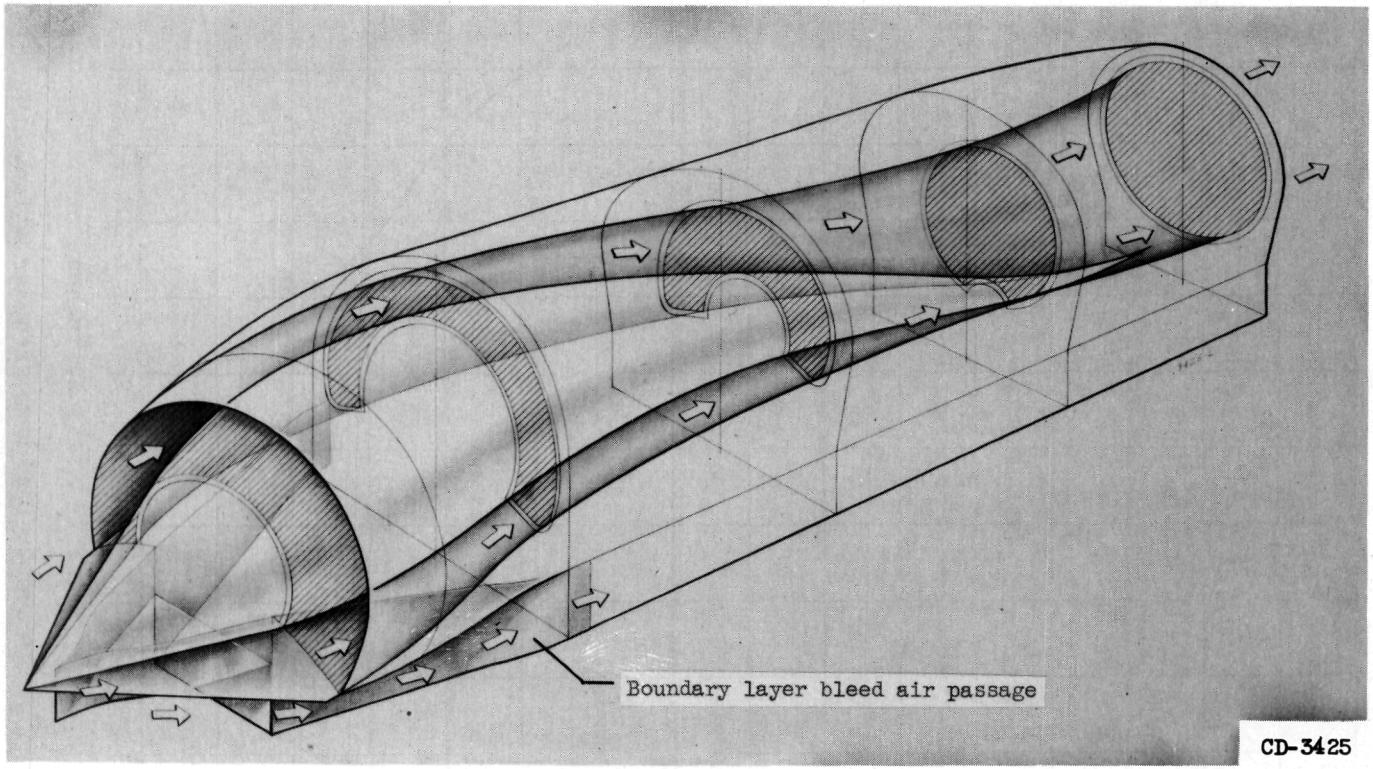


Figure 1. - Isometric view of diffuser.

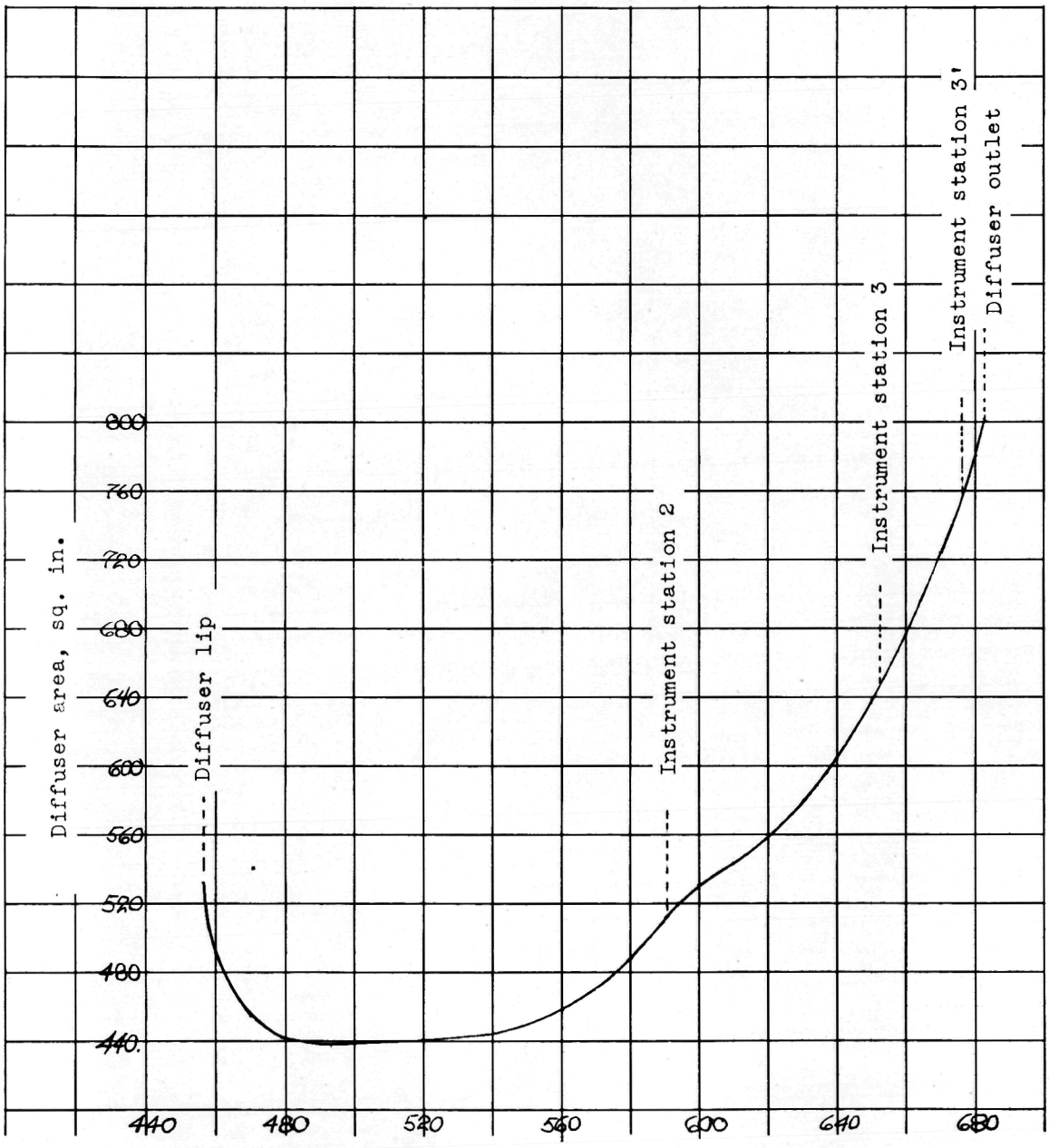


Figure 2. Diffuser area variation.

[redacted]

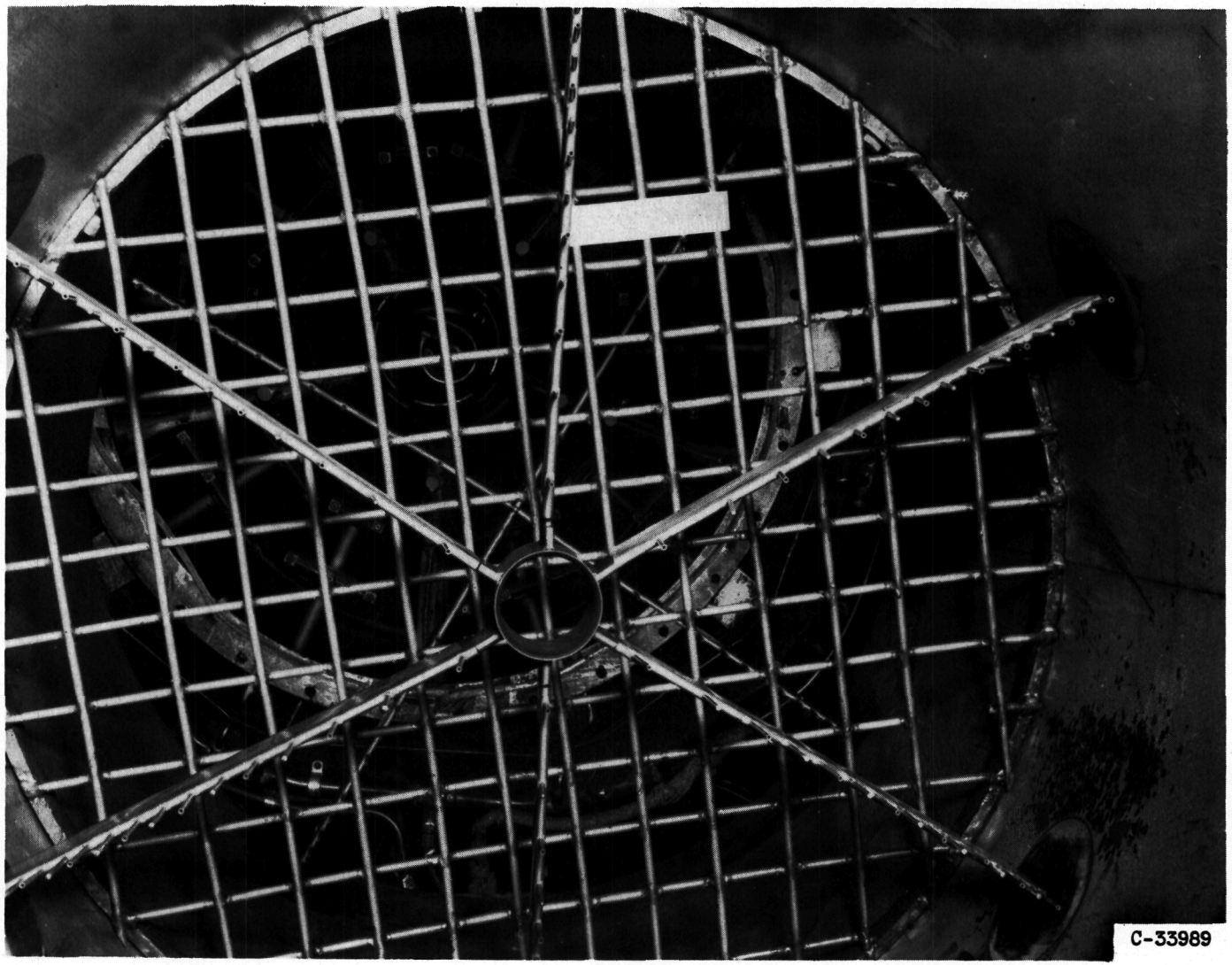
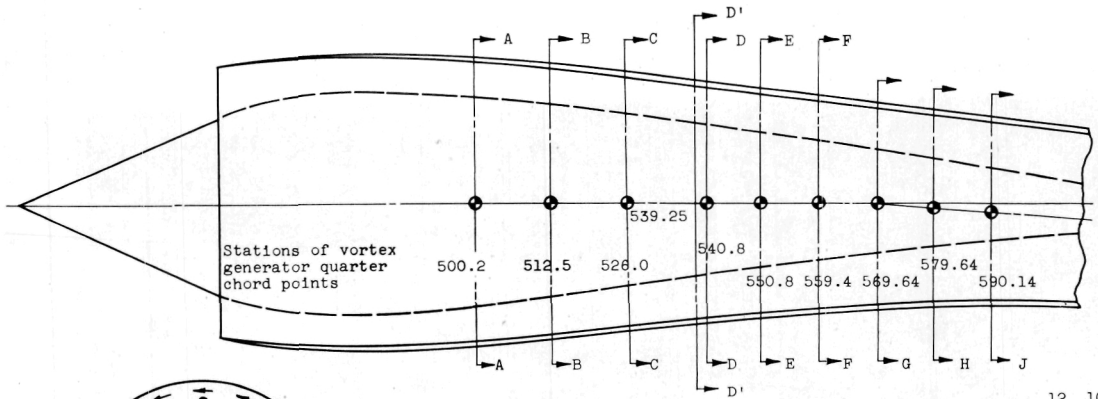
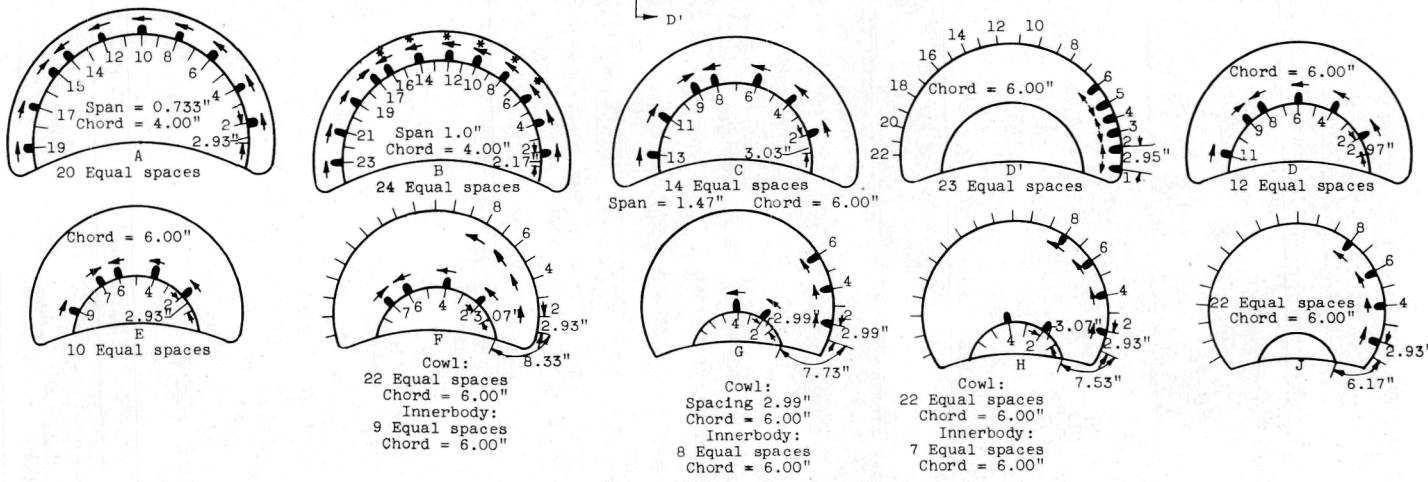


Figure 3. - Photograph of full screen installed in diffuser. View looking downstream. Screen was constructed of $\frac{1}{4}$ inch diameter rods and blocked 30 percent of the crossectional area.



VORTEX GENERATOR SPANS (Rows D thru J)

Row	Configuration D18C-116		Configuration D18C-116	
	Innerbody	Cowl	Innerbody	Cowl
D	1.65"	----	1.35"	----
E	1.65"	----	1.35"	----
F	1.98"	1.65"	1.61"	1.35"
G	2.31"	1.65"	1.87"	1.35"
H	2.64"	1.65"	2.14"	1.35"
J	-----	1.98"	-----	1.61"



Notes:

1. Configuration D18C-55 and D18C-28 used rows A, B, C, and D' only. For configuration D18C-55, the angles of attack of some of the vortex generators in rows B and C were reversed, as shown on the section drawings.
2. Configurations D18C-116 and D18C-116a used all the rows except row D'. For configuration D18C-116a, the spans of the generators in rows D through J were reduced approximately 19 percent.
3. Section views rotated 90° - looking aft.
4. Stations are trace stations at point. ●
5. Arrows point in direction of vortex generator trailing edge.
6. Airfoil sections of vortex generators were symmetrical airfoils having a maximum thickness of 12 percent chord at the quarter chord-point.
7. Vortex generators are set at 15° angles of attack to the flow at any particular vortex generator location.

*Indicates generators whose angle of attack has been reversed for configuration D18C-55.

Figure 4. - Description of vortex generator configurations.

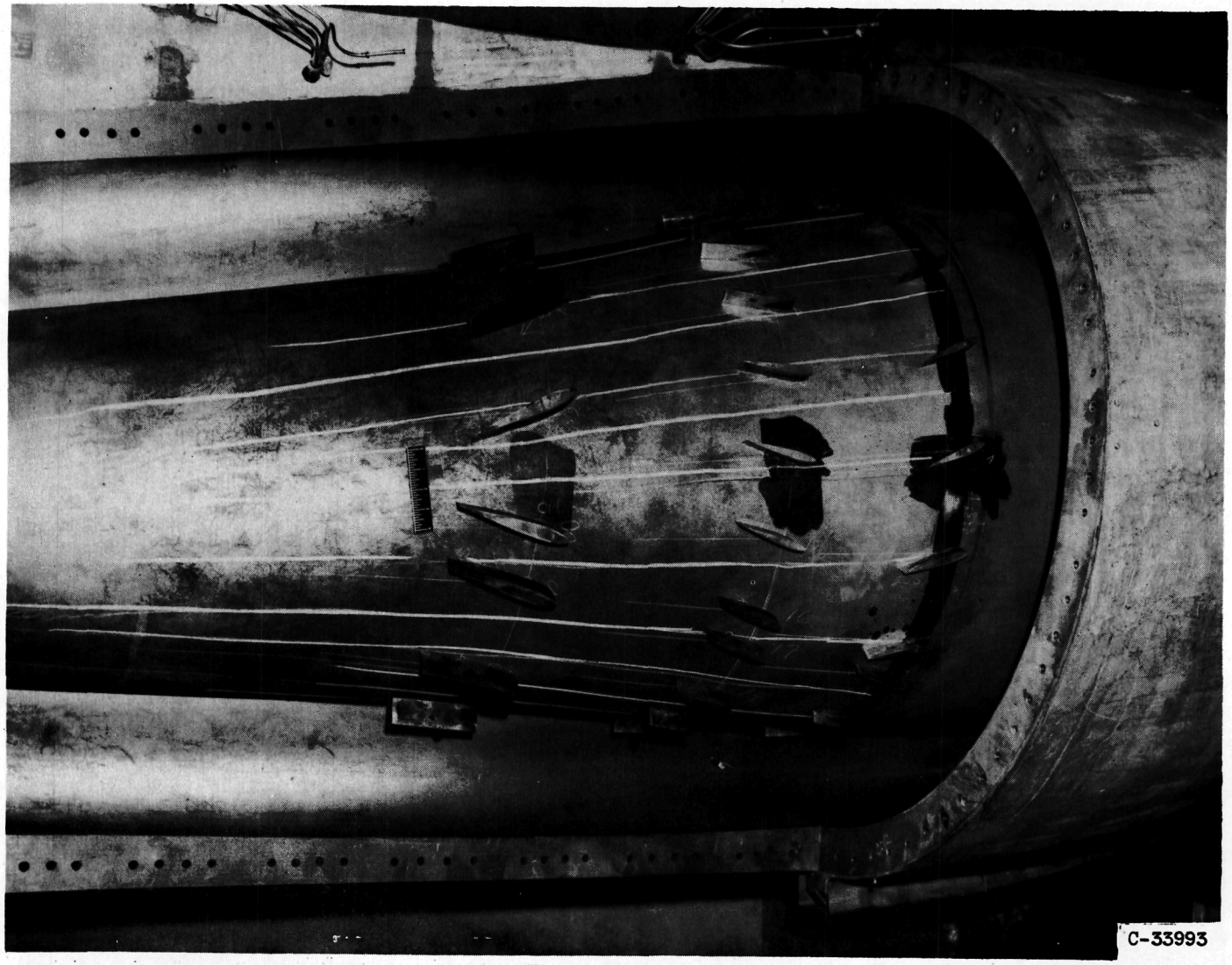


Figure 5. - Photograph of vortex generators installed on diffuser innerbody. Vortex generator configuration D 18C-55.

[redacted]

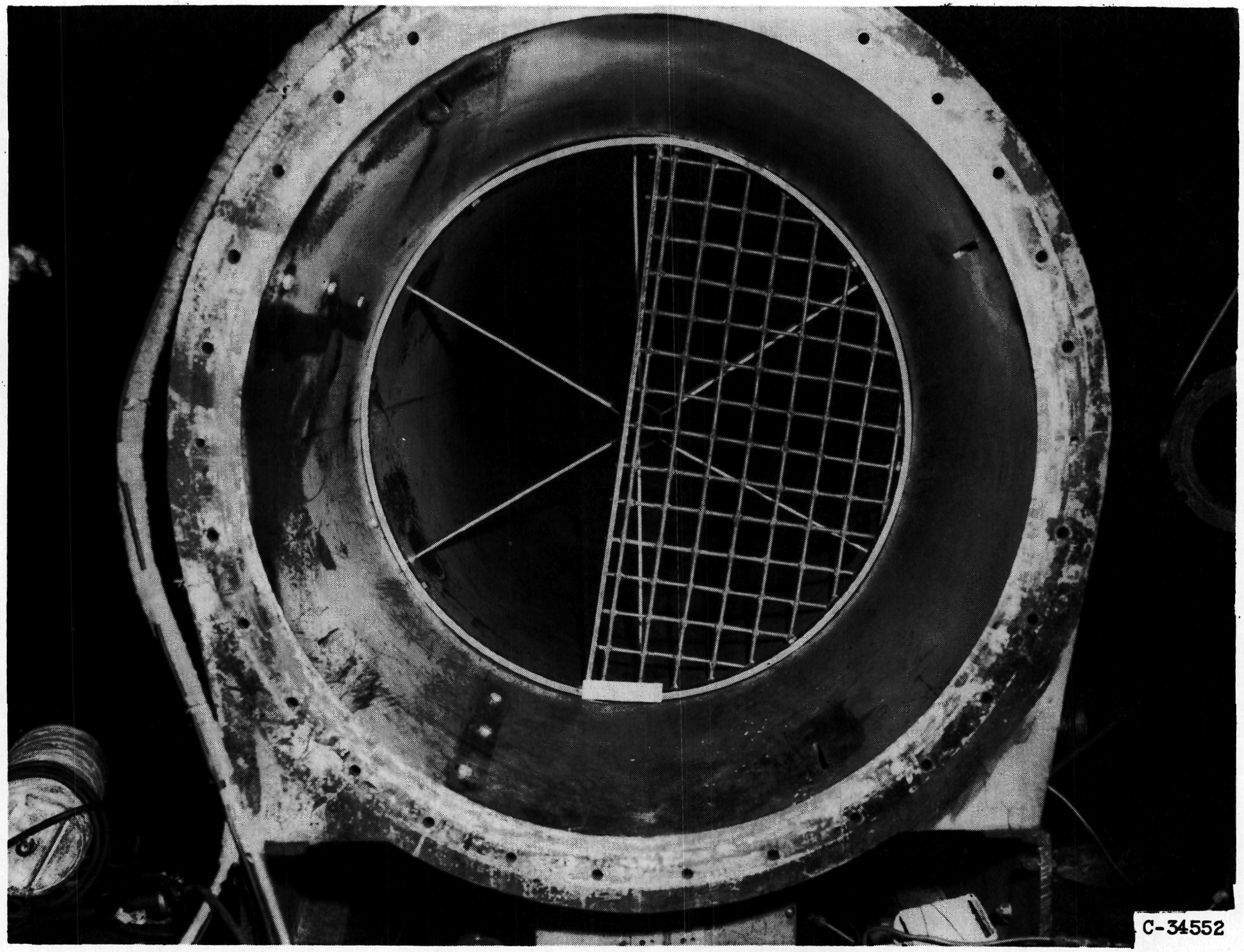


Figure 6. - Photograph of half screen installed in diffuser duct. View looking upstream. Constructed of $\frac{1}{4}$ inch diameter rods, spaced $1\frac{7}{8}$ inches on centers.

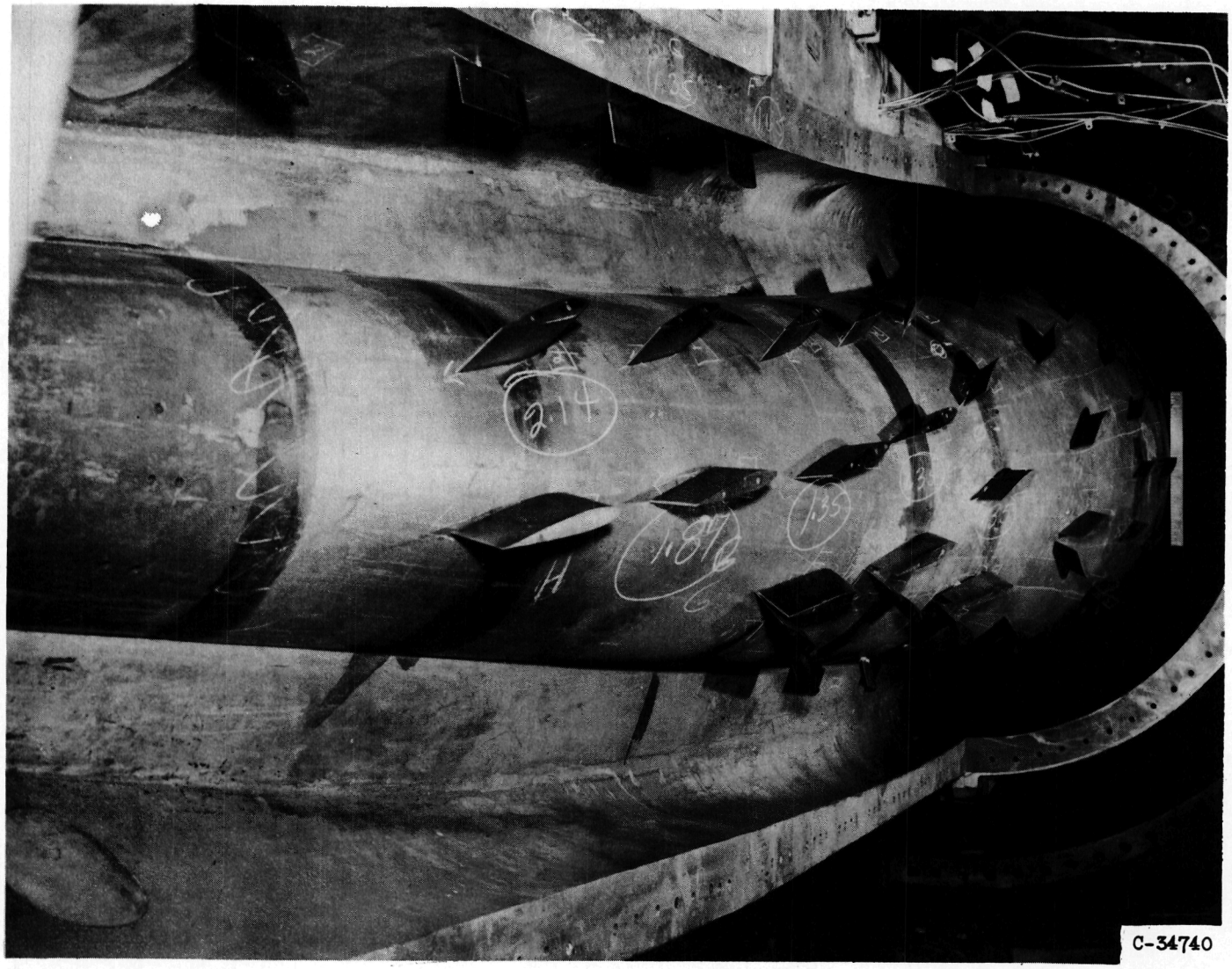


Figure 7. - Photograph of installation of vortex generator configuration D 18C-116. View looking upstream.

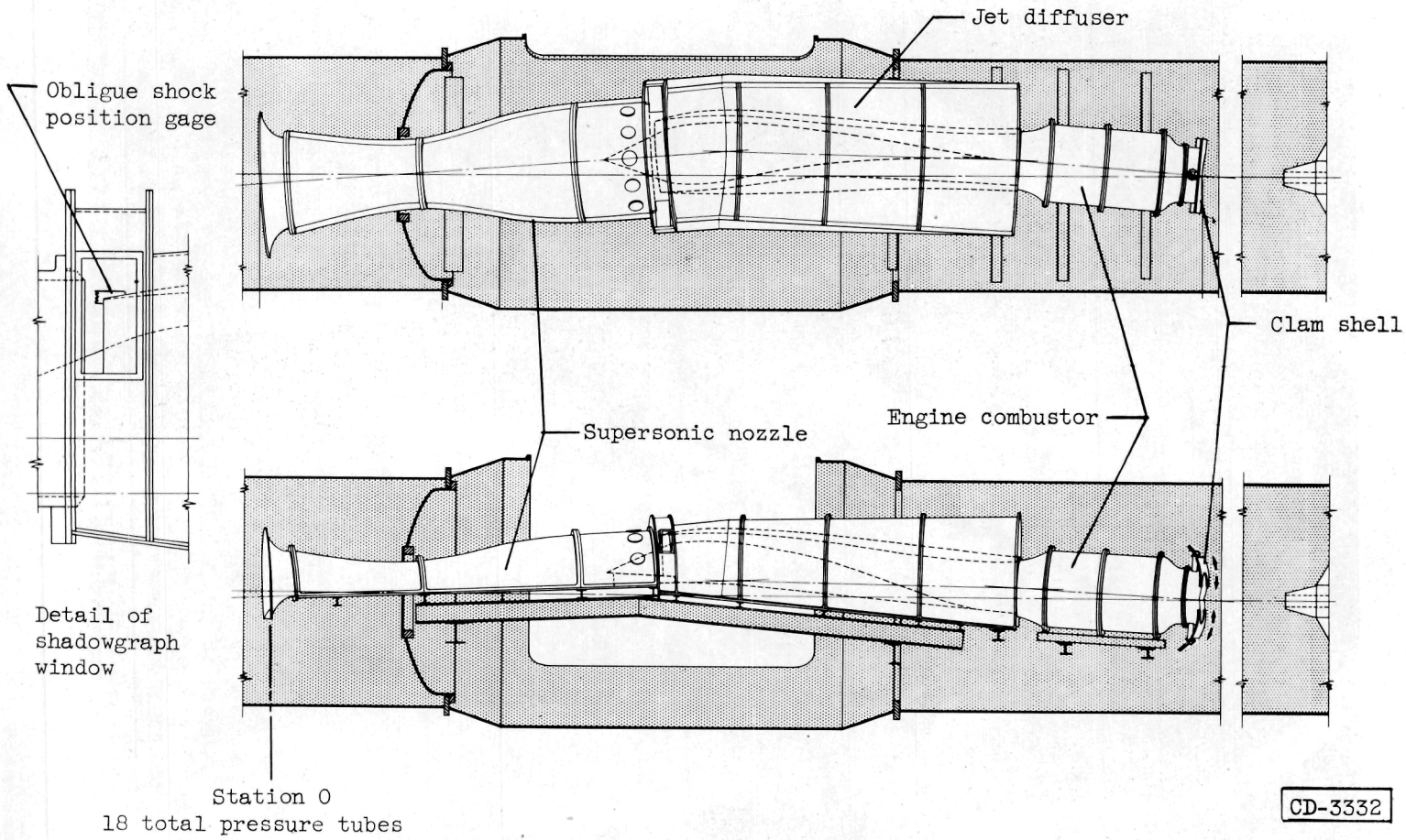
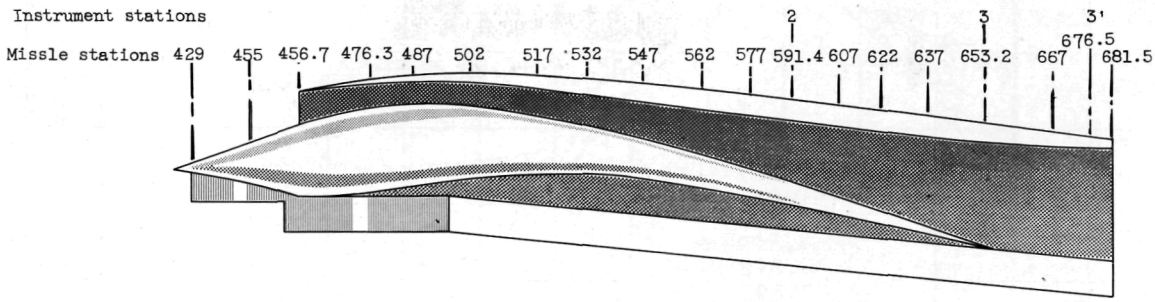
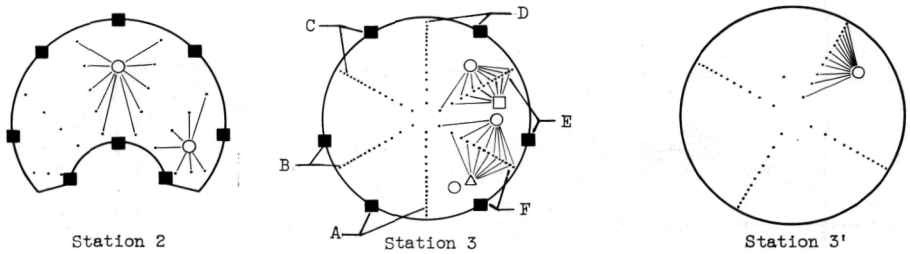


Figure 8. - Free jet test facility and engine installation.



(a) Side view showing instrumentation and missle stations.



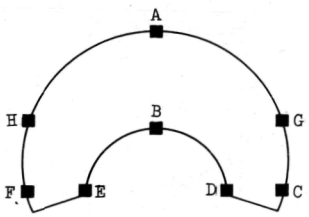
(b) Diffuser instrumentation stations looking downstream.

■ Wall static pressure tap

□ Static pressure probe

△ Thermocouple probe

○ Total-pressure probe



Typical section looking downstream

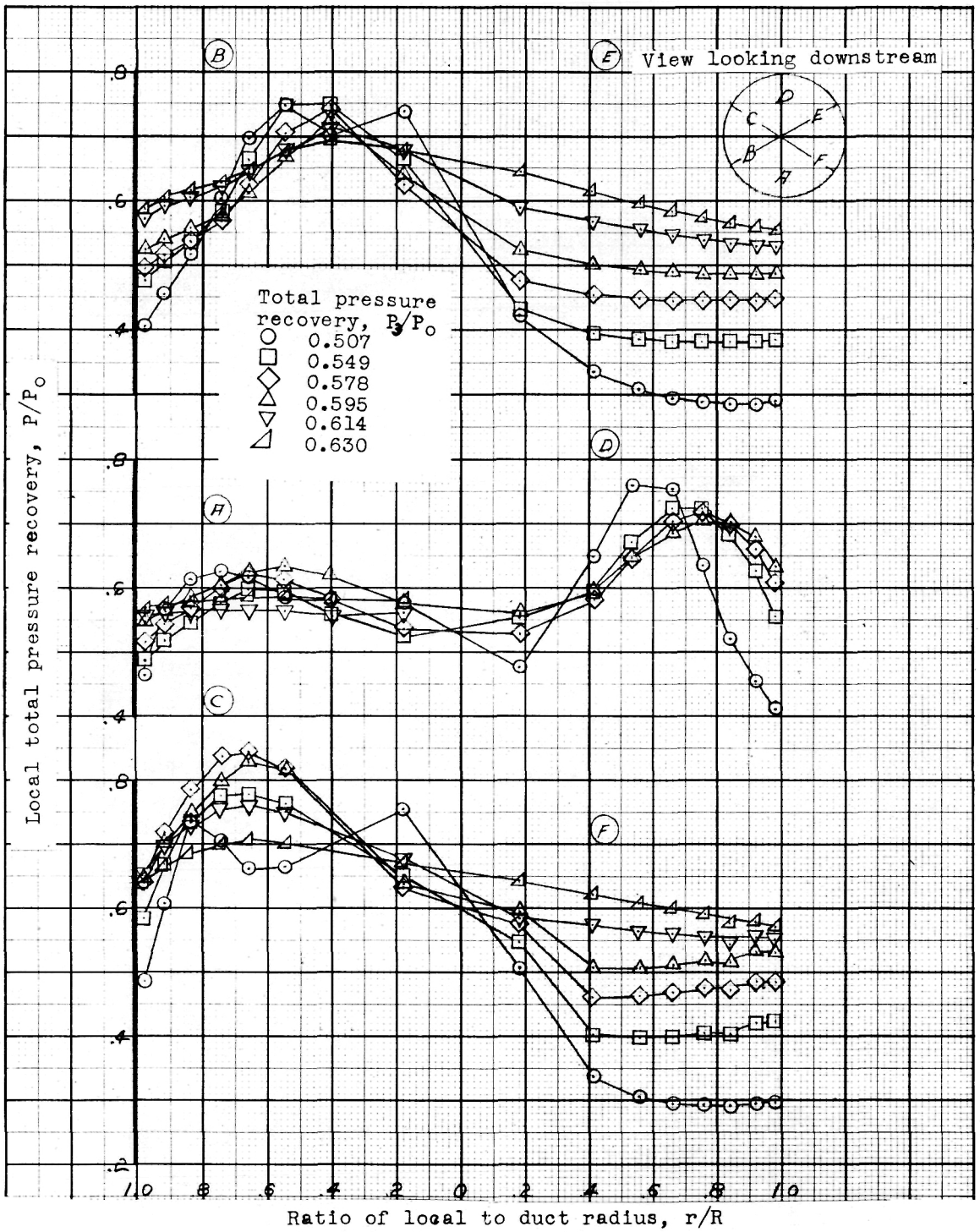
Missle station	Circumferential section
429	BDE
445	BDE
476.5	ABCDEFGH
487	AB
502	ABCDEFGH
517	AB
532	ABCDEFGH
547	AB
562	ABCDEFGH
577	AB
607	AB
622	ABCF
637	AB
667	AB

(c) Location of wall static taps.

CD 3455

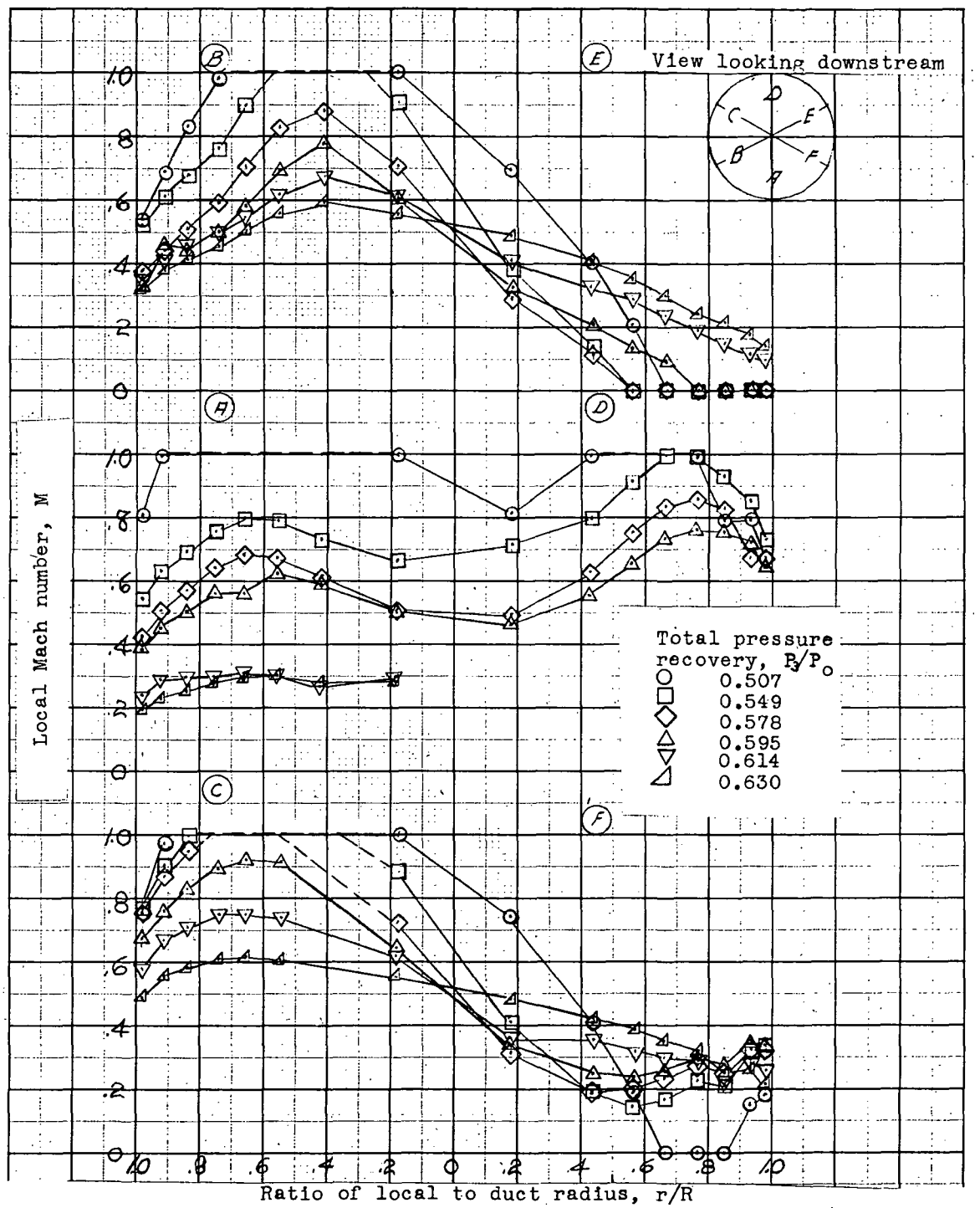
Figure 9. - Details of instrumentation.

[redacted]



(a) Diffuser outlet pressure recovery profile.

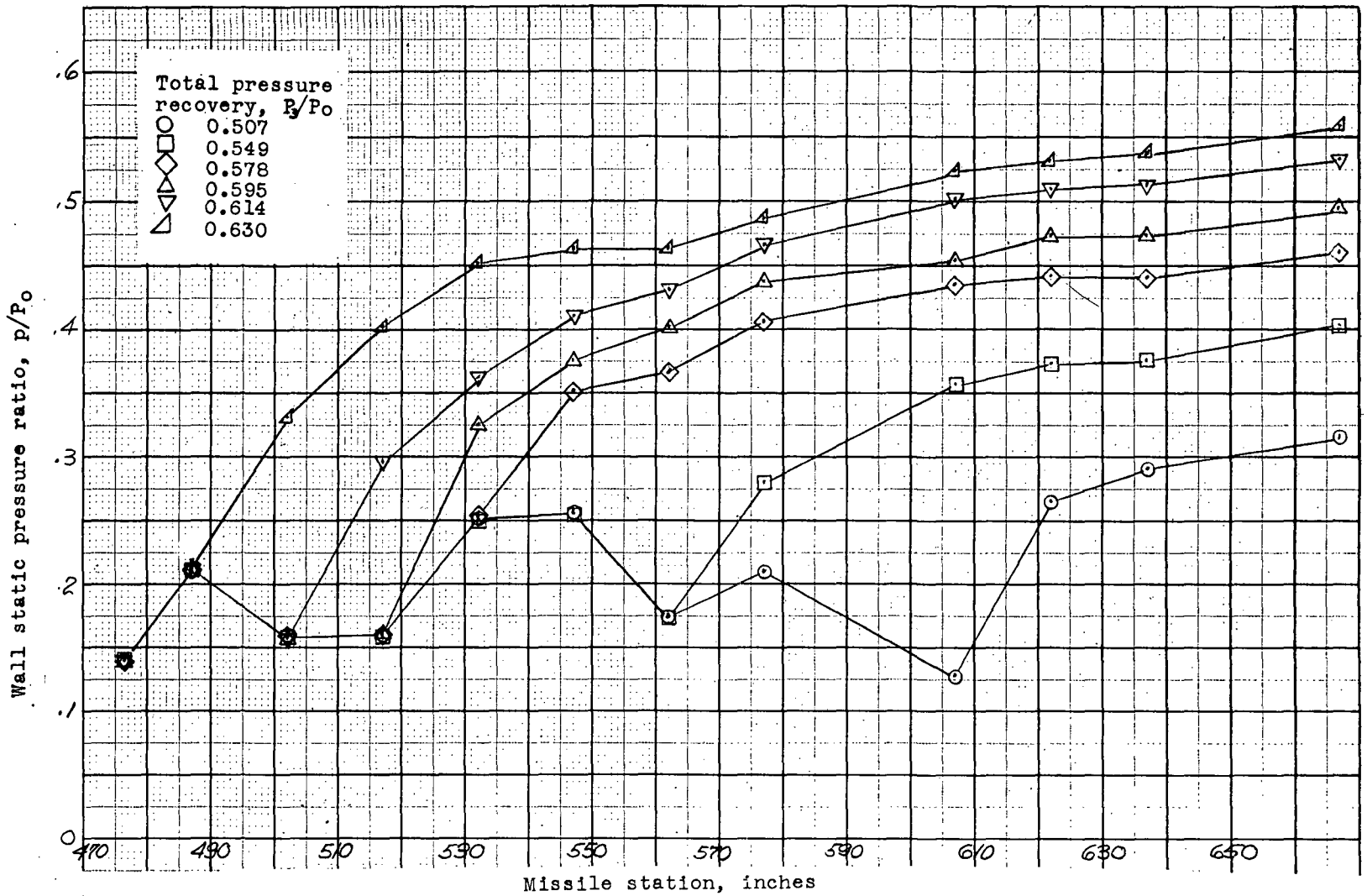
Figure 10. - Performance of original diffuser configuration.



(b) Diffuser outlet Mach number profile.

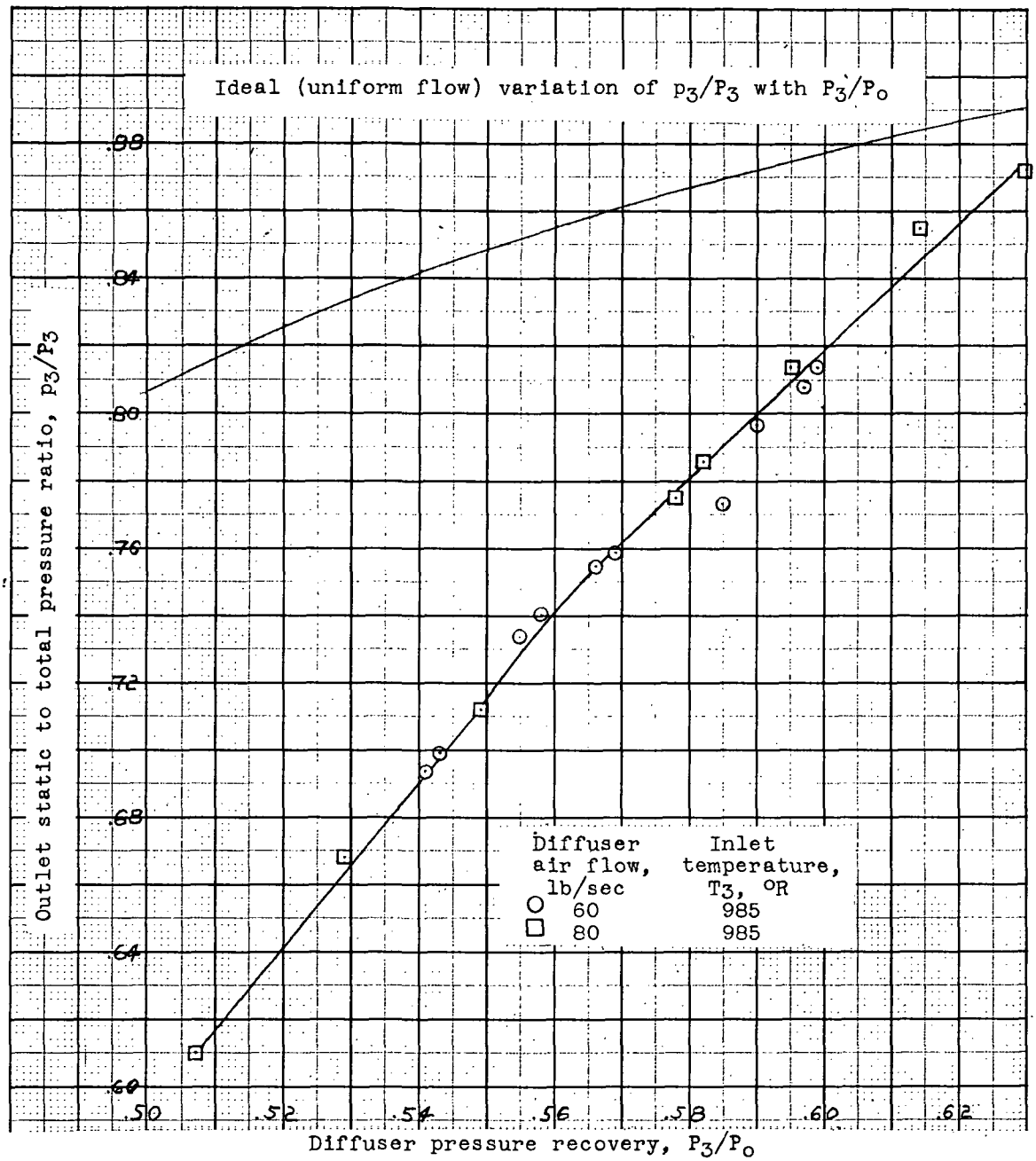
Figure 10. -Continued. Performance of original diffuser configuration.

[redacted]



(c) Longitudinal wall static pressure distribution.

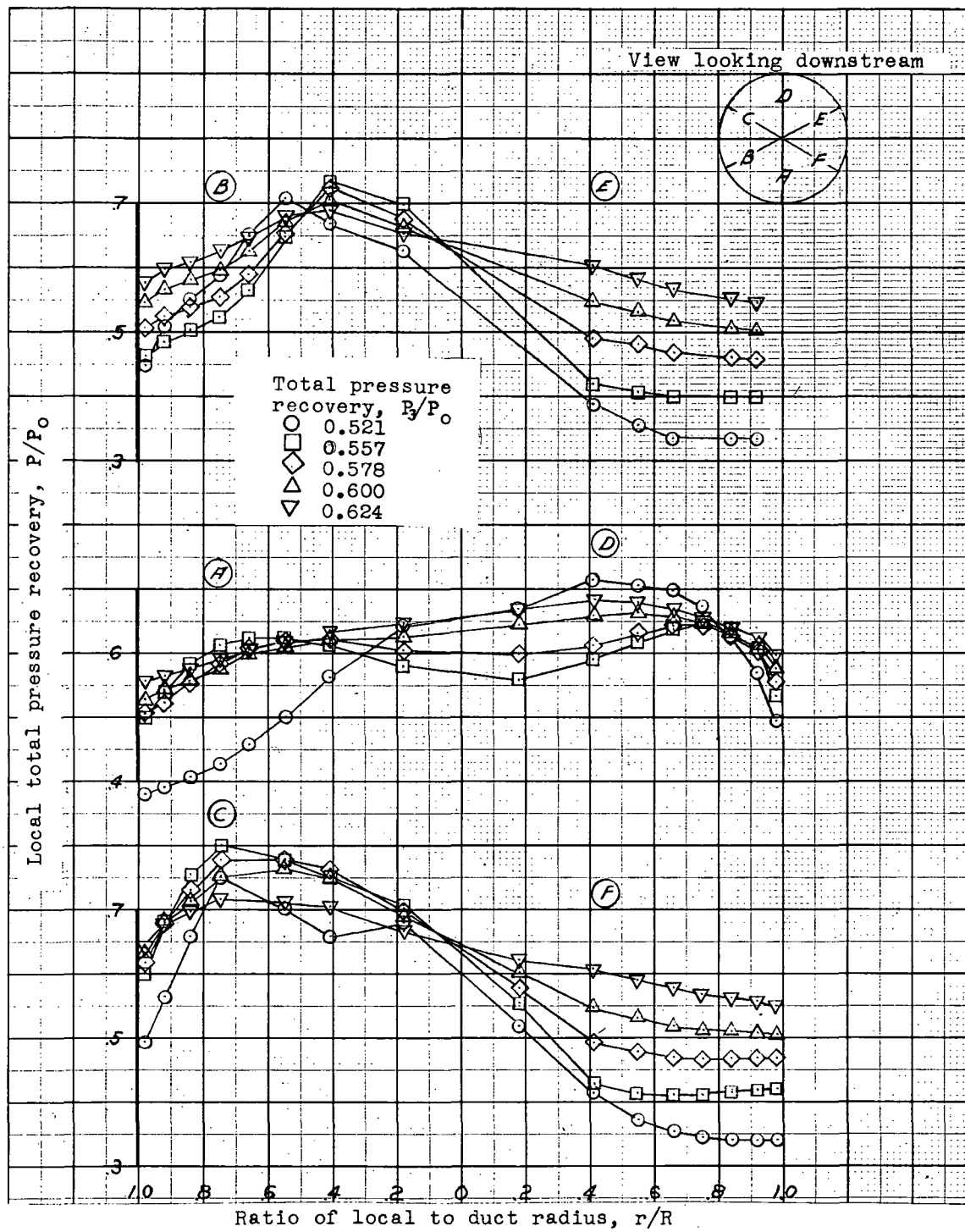
Figure 10. Continued. Performance of original diffuser configuration,



(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

Figure 10. -Concluded. Performance of original diffuser configuration.

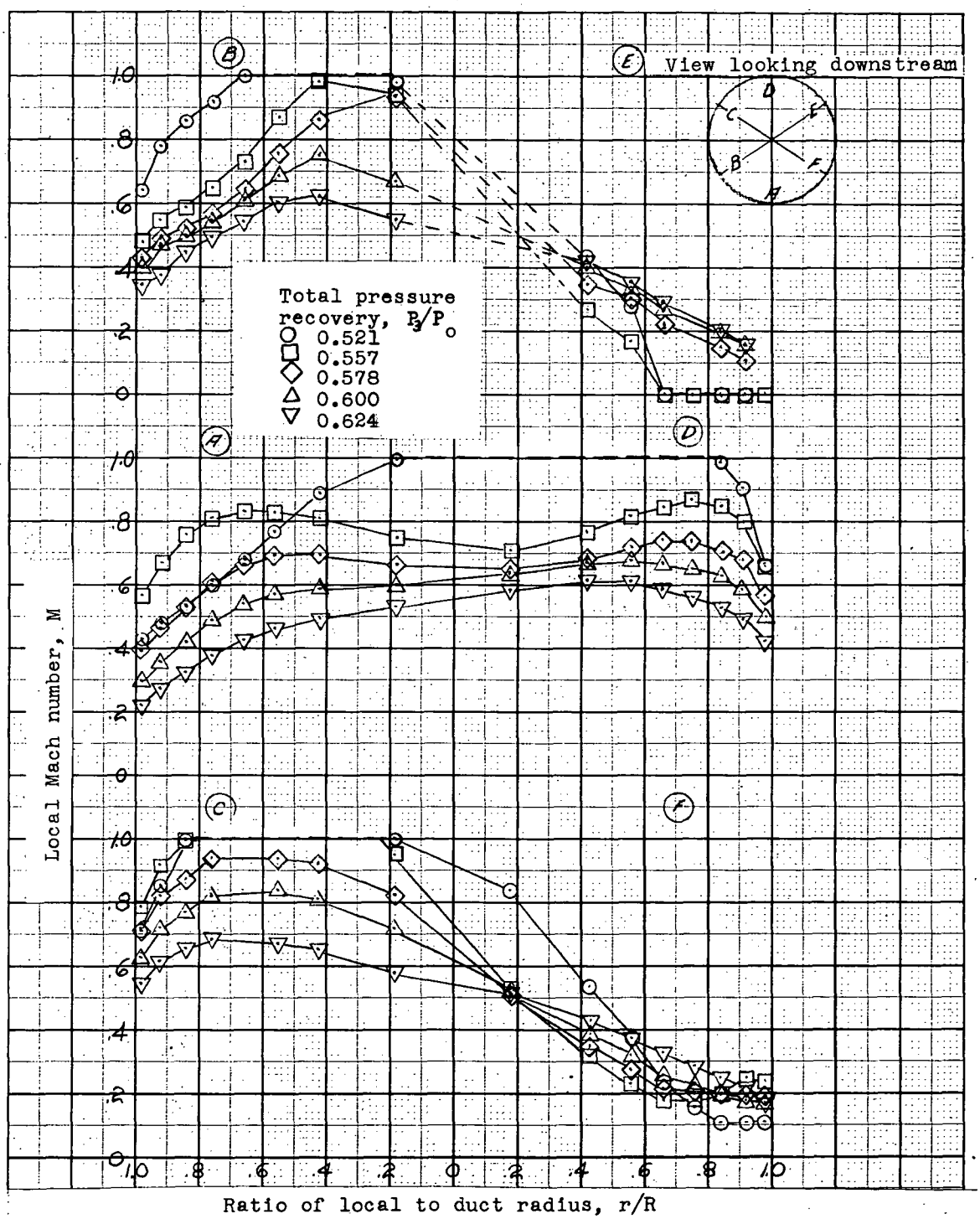
[redacted]



(a) Diffuser outlet pressure recovery profile.

Figure 11. Performance of original diffuser configuration with rakes installed at a intermediate point in the diffuser.

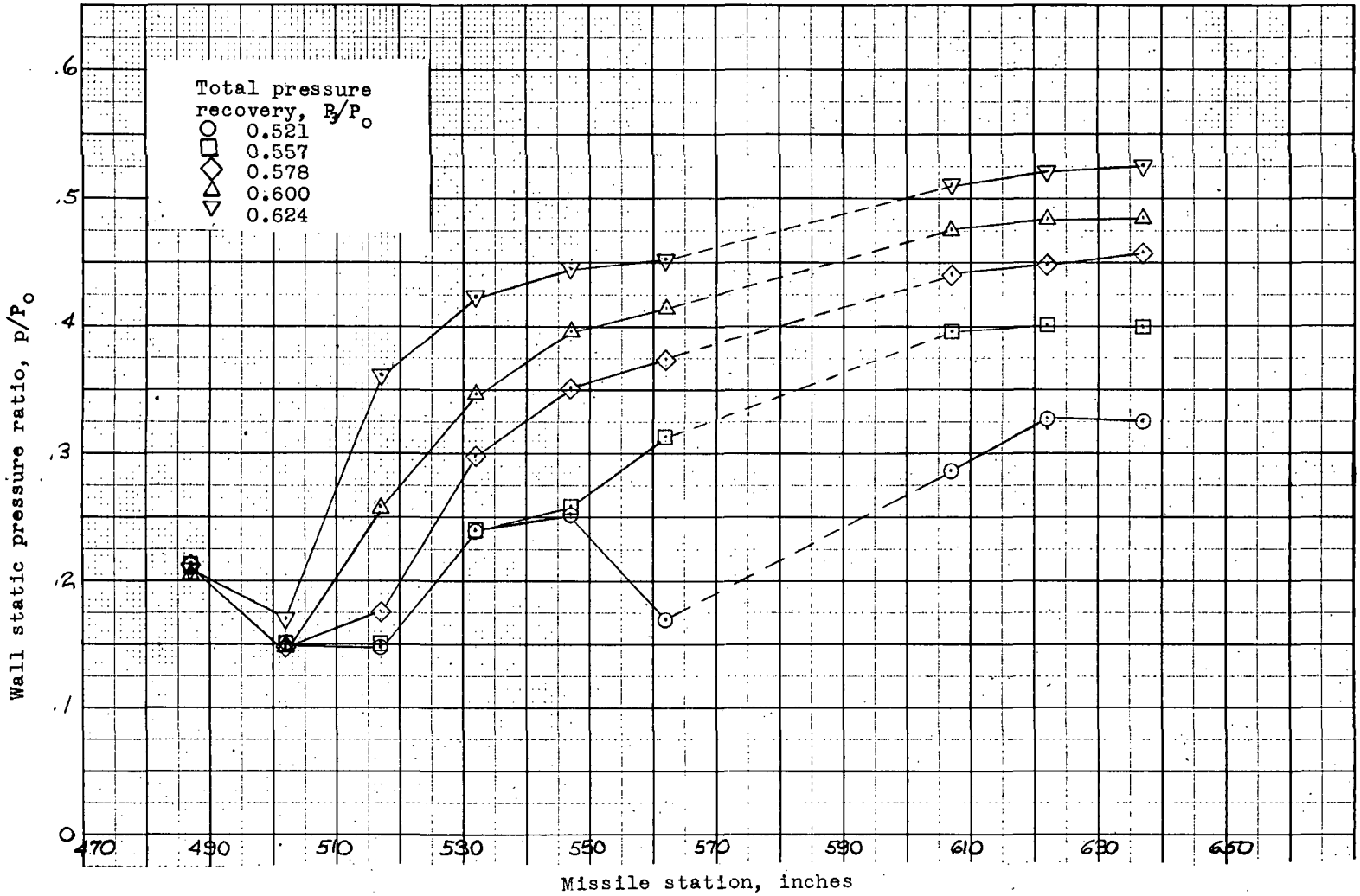
[redacted]



(b) Diffuser outlet Mach number profile.

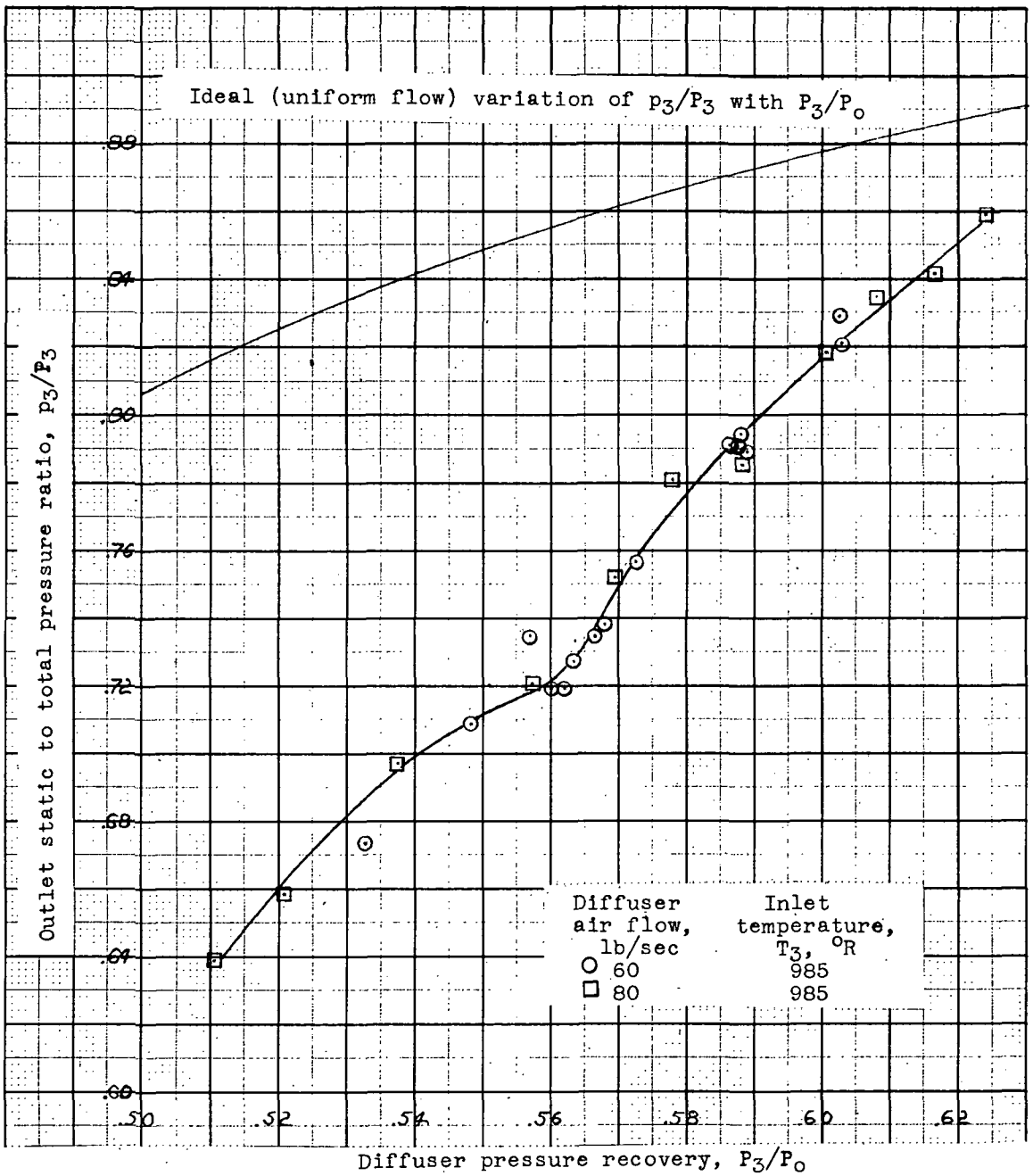
Figure 11. -Continued. Performance of original diffuser configuration with rakes installed at a intermediate point in diffuser.

[redacted]



(c) Longitudinal wall static pressure distribution.

Figure 11. -Continued. Performance of original diffuser configuration with rakes installed at a intermediate point in the diffuser.

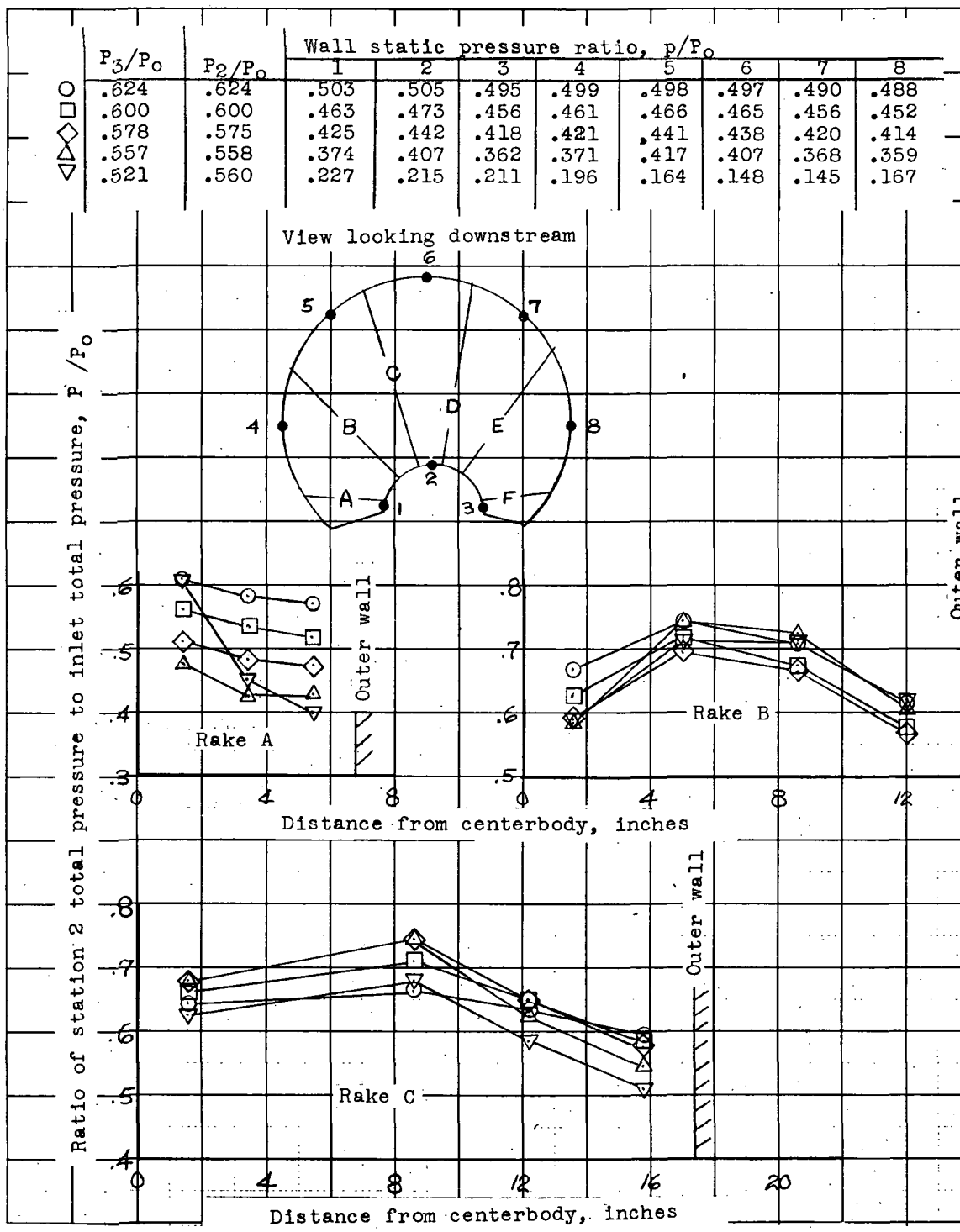


(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

Figure 11.-Continued. Performance of original diffuser configuration with rakes installed at a intermediate point in diffuser.

[redacted]

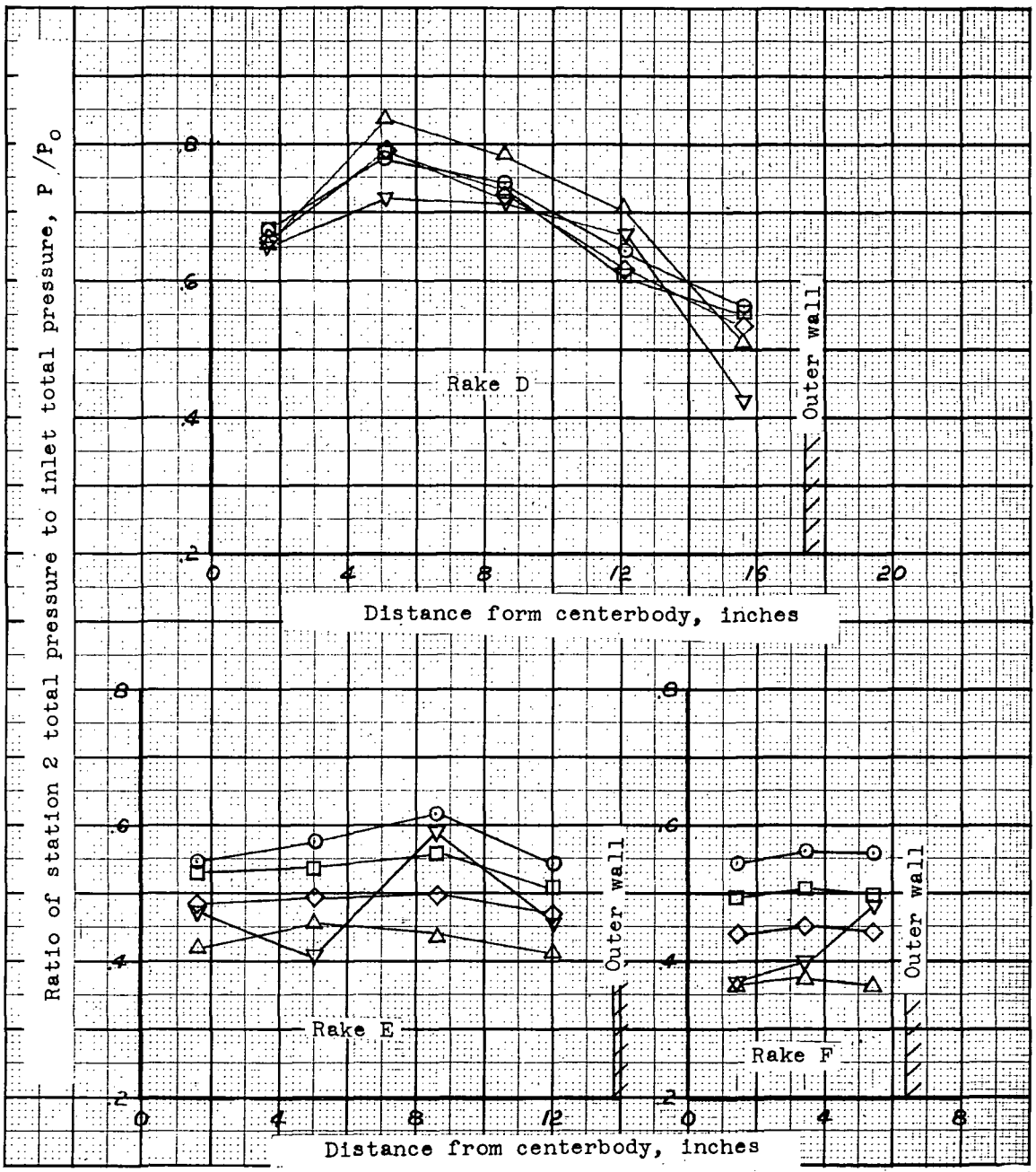
	P_3/P_o	P_2/P_o	Wall static pressure ratio, p/P_o							
			1	2	3	4	5	6	7	8
○	.624	.624	.503	.505	.495	.499	.498	.497	.490	.488
□	.600	.600	.463	.473	.456	.461	.466	.465	.456	.452
◇	.578	.575	.425	.442	.418	.421	.441	.438	.420	.414
△	.557	.558	.374	.407	.362	.371	.417	.407	.368	.359
▽	.521	.560	.227	.215	.211	.196	.164	.148	.145	.167



(e) Total pressure recovery at station 2.

Figure 11. -Continued. Performance of original diffuser configuration with rakes installed at a intermediate point in diffuser.

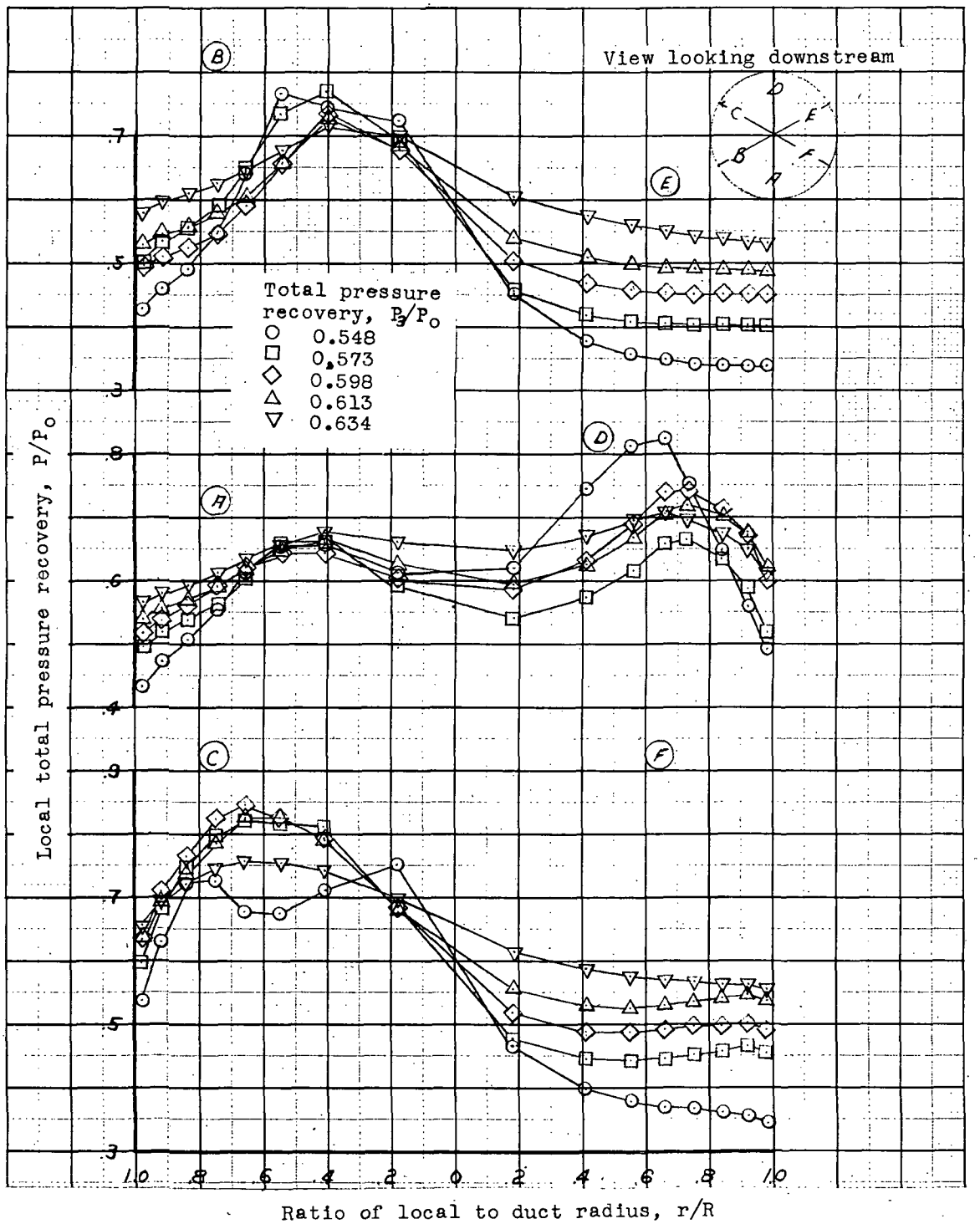
[redacted]



(e)- Concluded. Total pressure recovery at station 2.

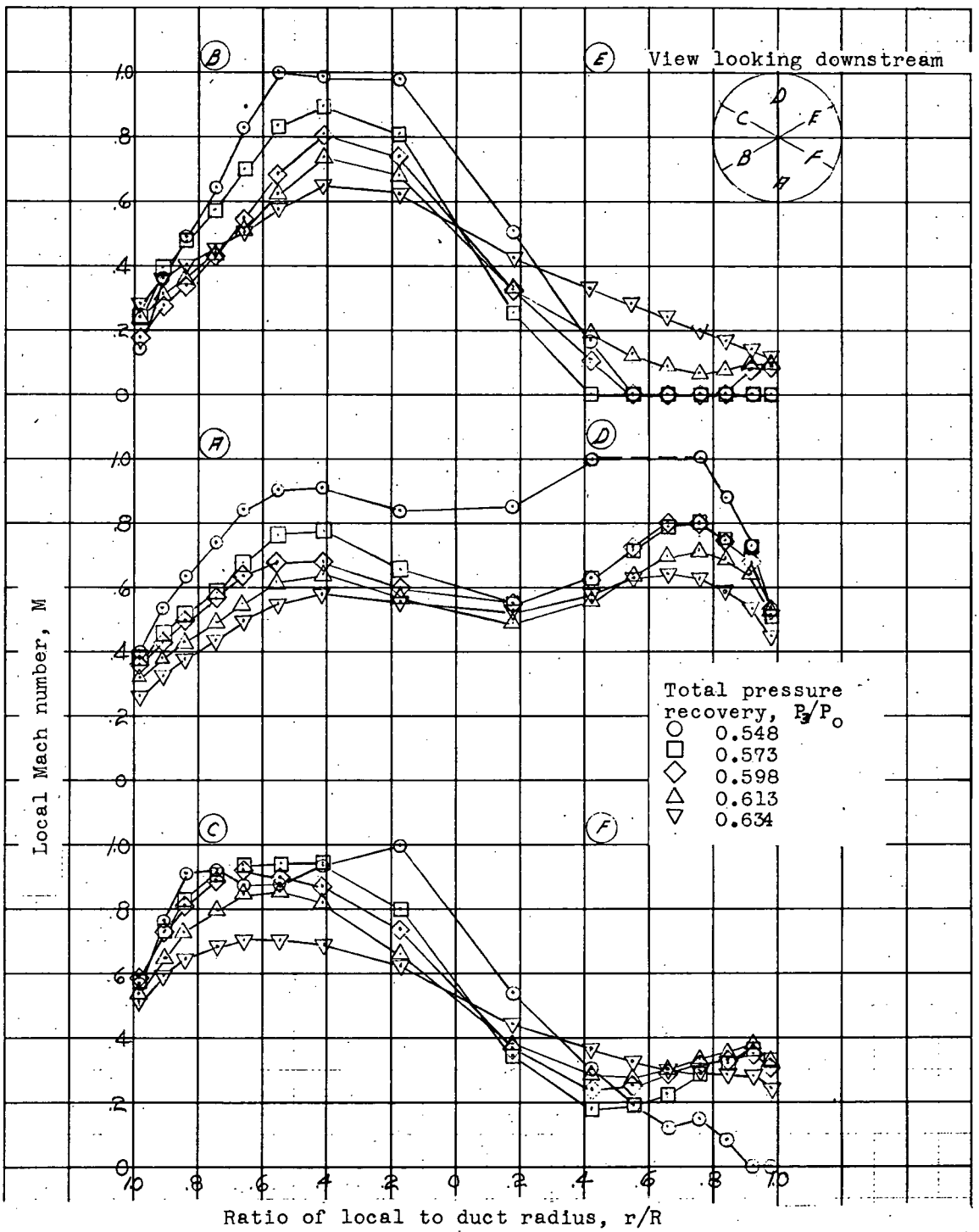
Figure 11. -Concluded. Performance of original diffuser configuration with rakes installed at a intermediate point in the diffuser.

[redacted]



(a) Diffuser outlet pressure recovery upstream of screen.

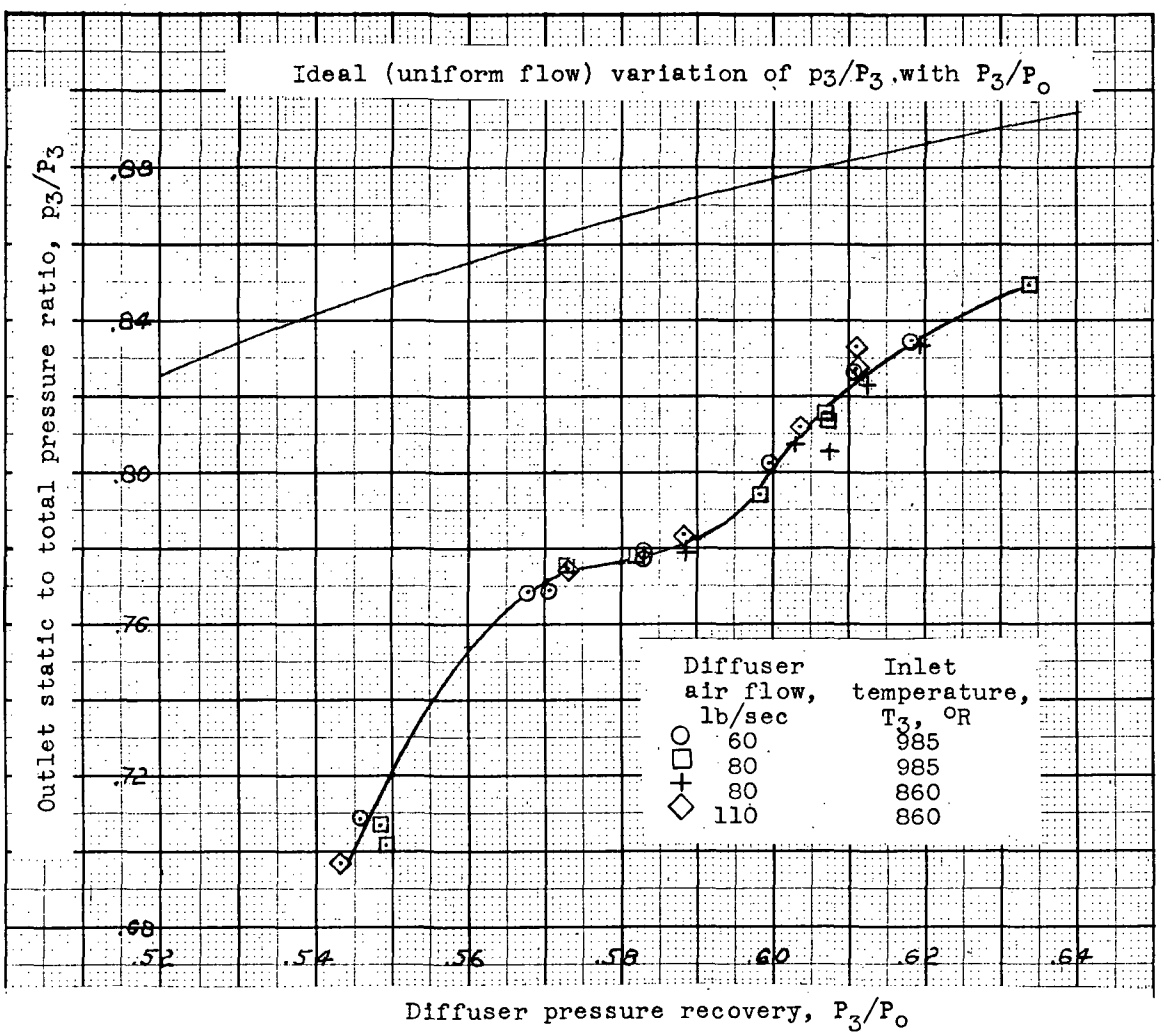
Figure 12. Performance of diffuser full screen configuration.



(b) Diffuser outlet Mach number profile upstream of screen.

Figure 12. -Continued. Performance of diffuser full screen configuration.

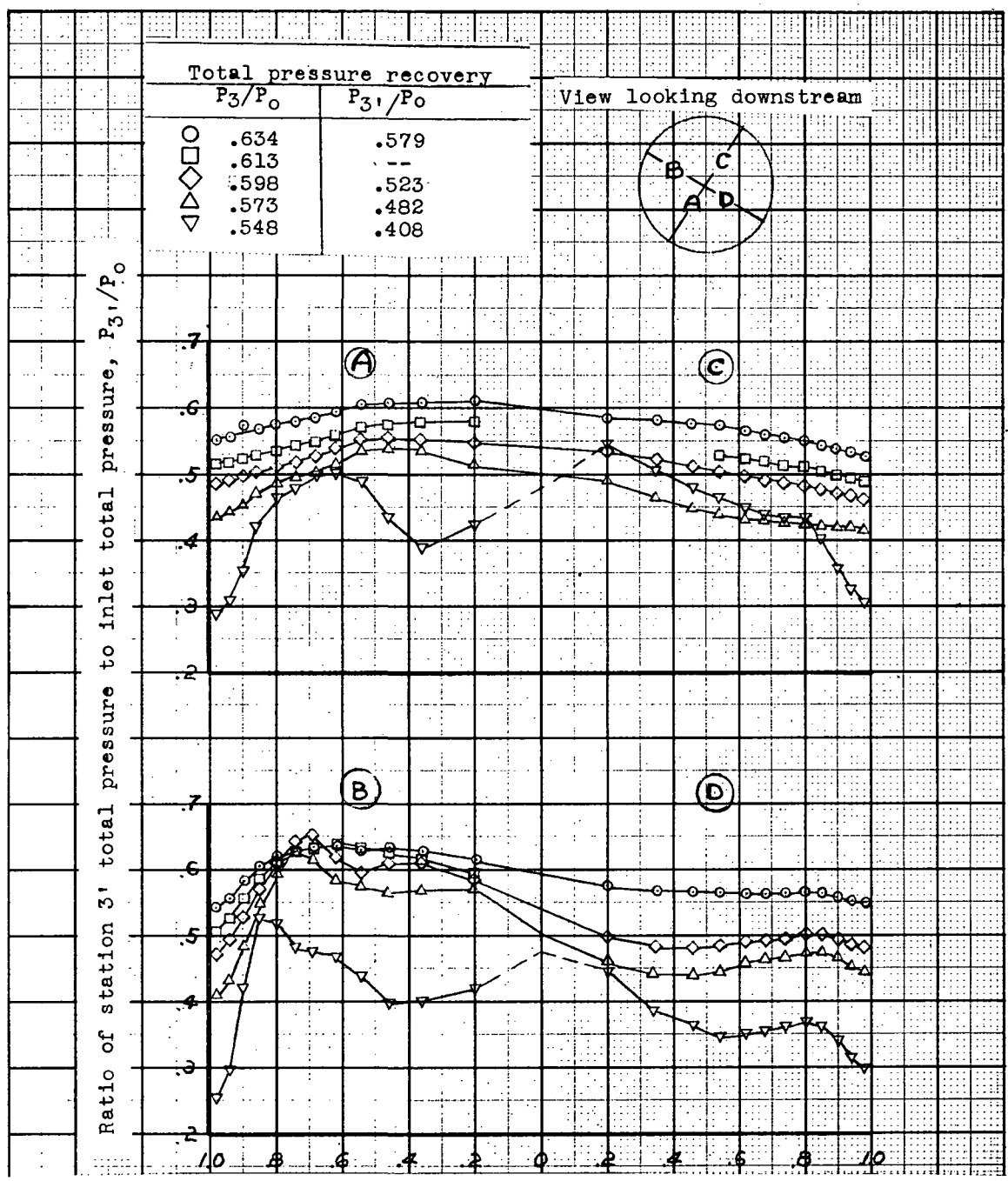
[redacted]



(c) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

Figure 12.-Continued. Performance of diffuser full screen configuration.

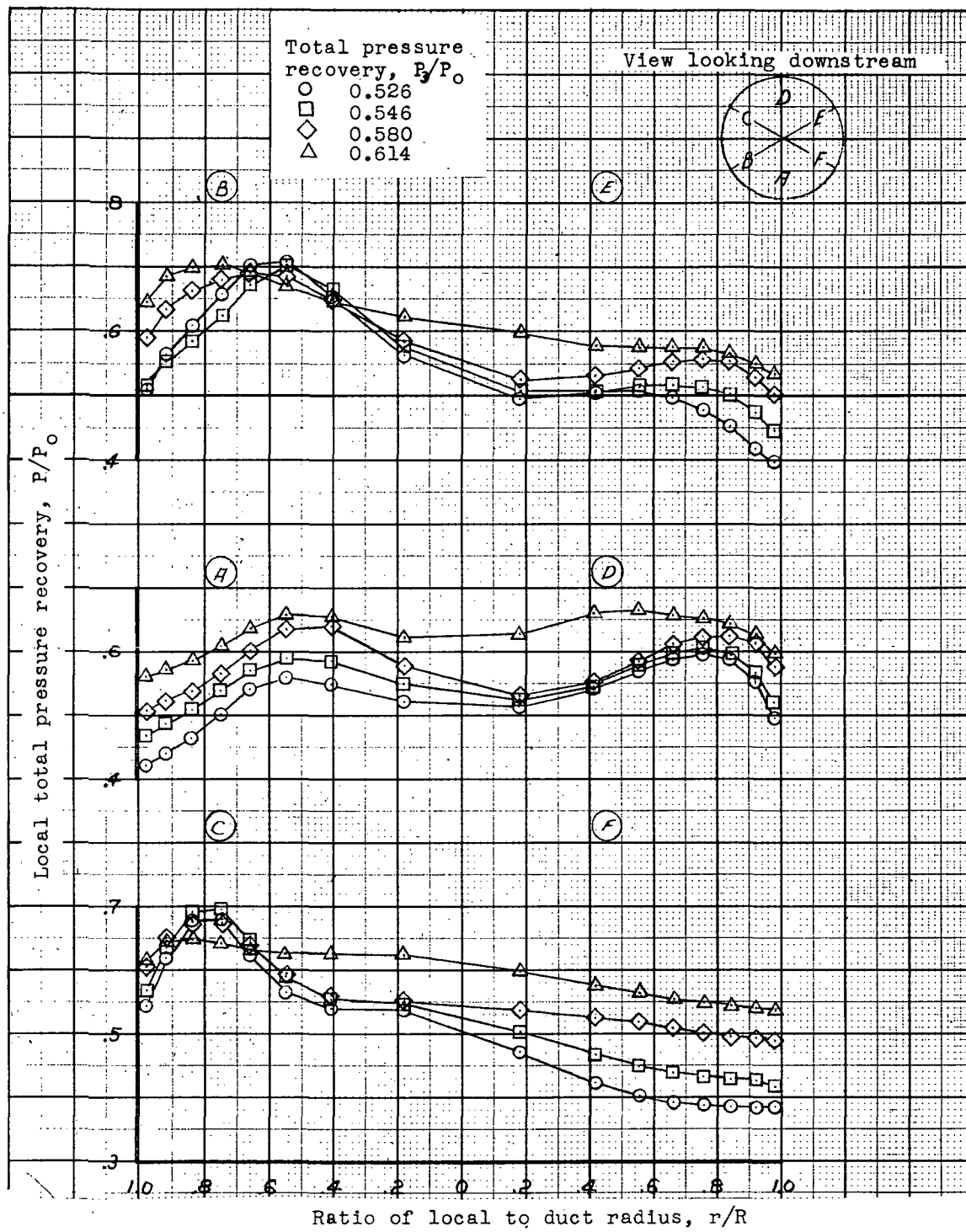
[redacted]



(d) Diffuser outlet pressure recovery downstream of screen.

Figure 12.. -Concluded. Performance of diffuser full screen configuration.

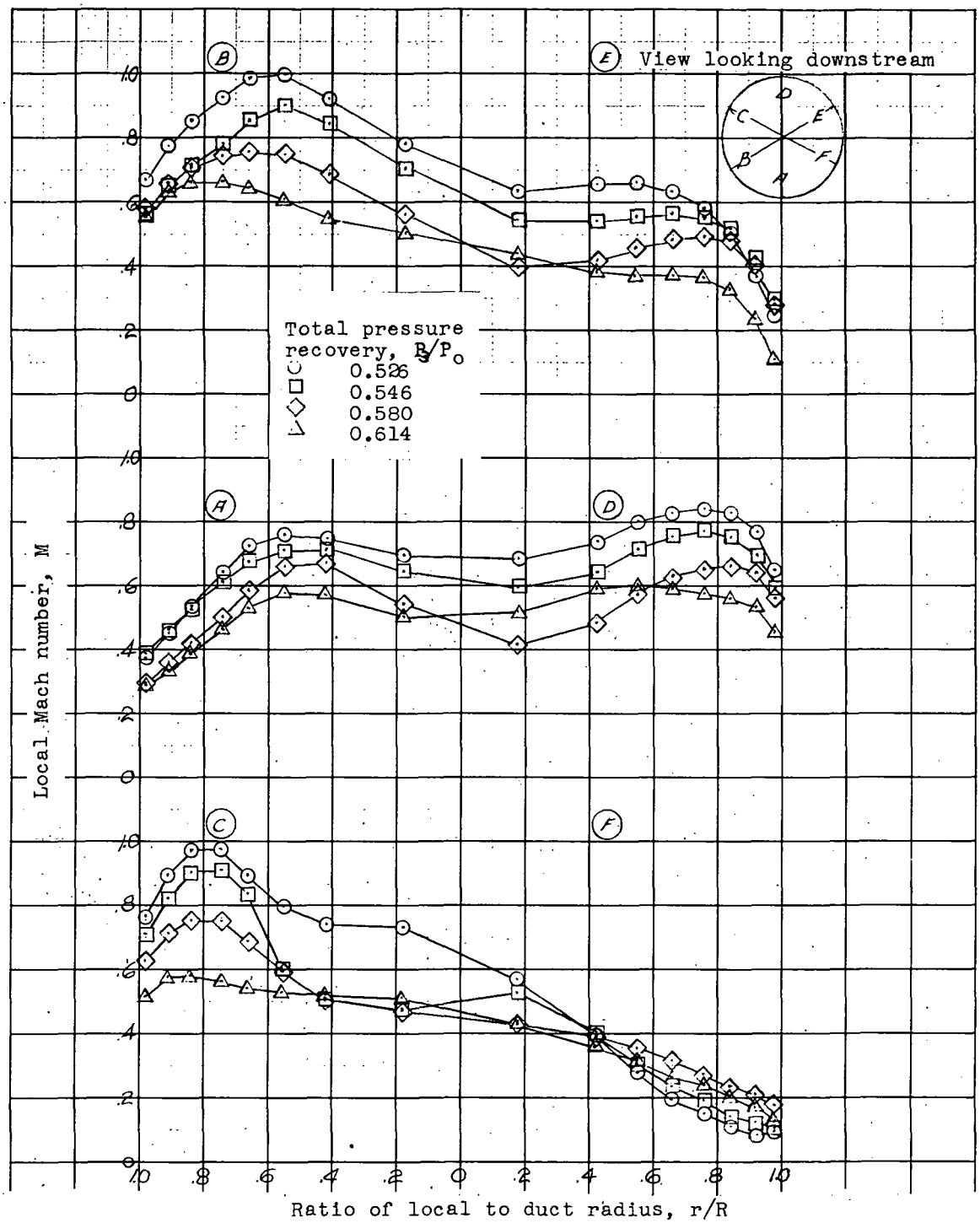
[redacted]



(a) Diffuser outlet pressure recovery profile.

Figure 13. Performance of diffuser D18C-55 vortex generator configuration.

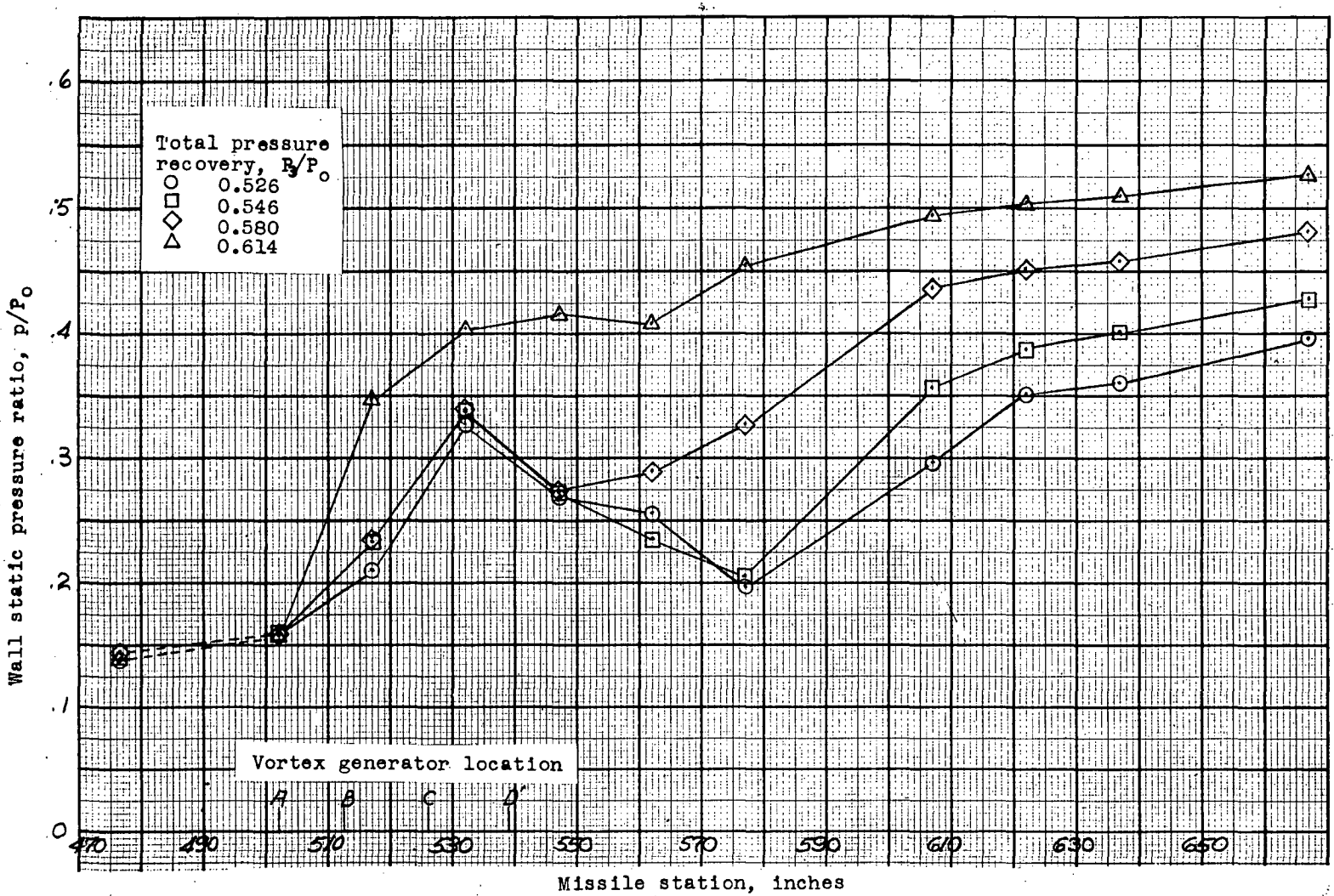
[redacted]



(b) Diffuser outlet Mach number profile.

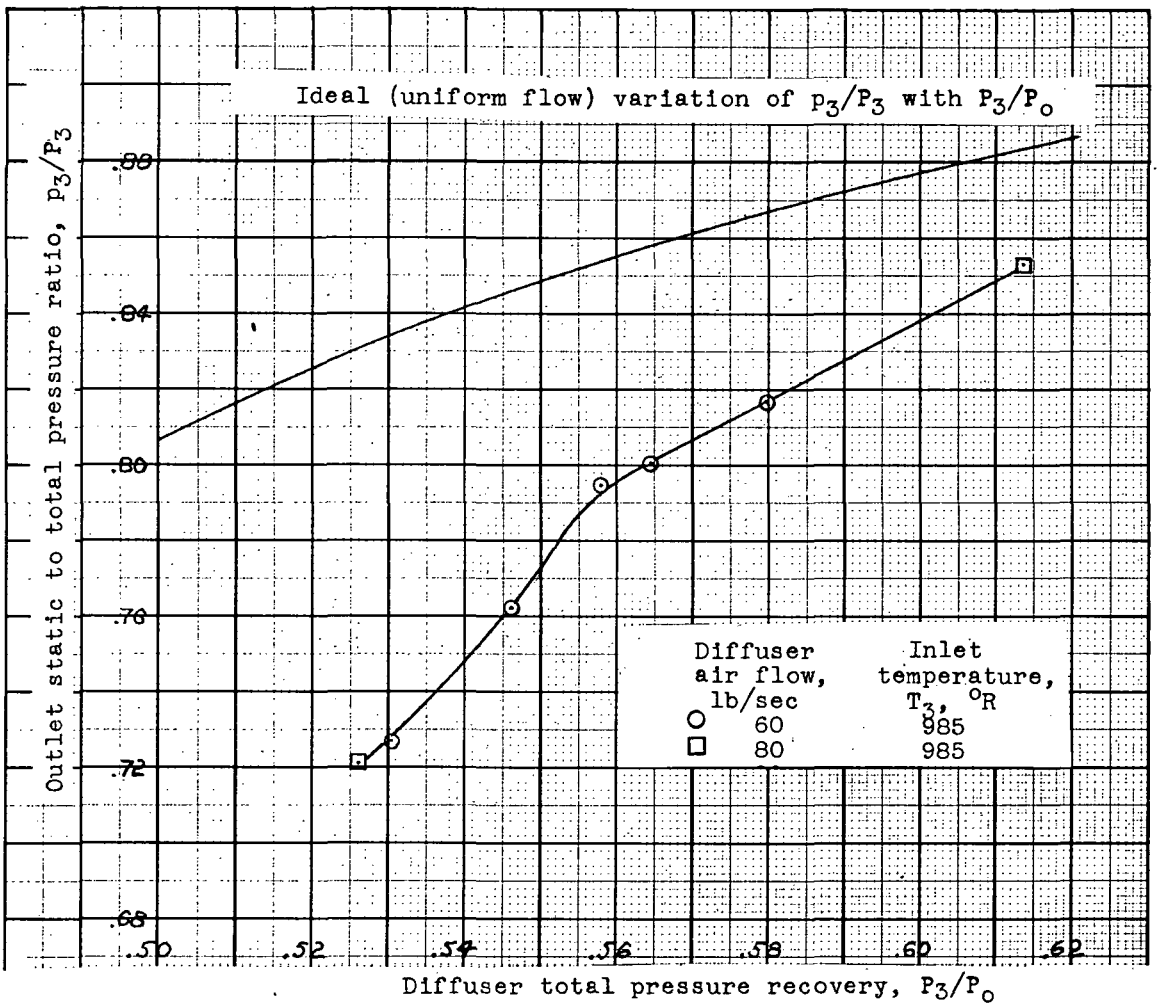
Figure 13. -Continued. Performance of diffuser D18C-55 vortex generator configuration.

[redacted]



(c) Longitudinal wall static pressure distribution.

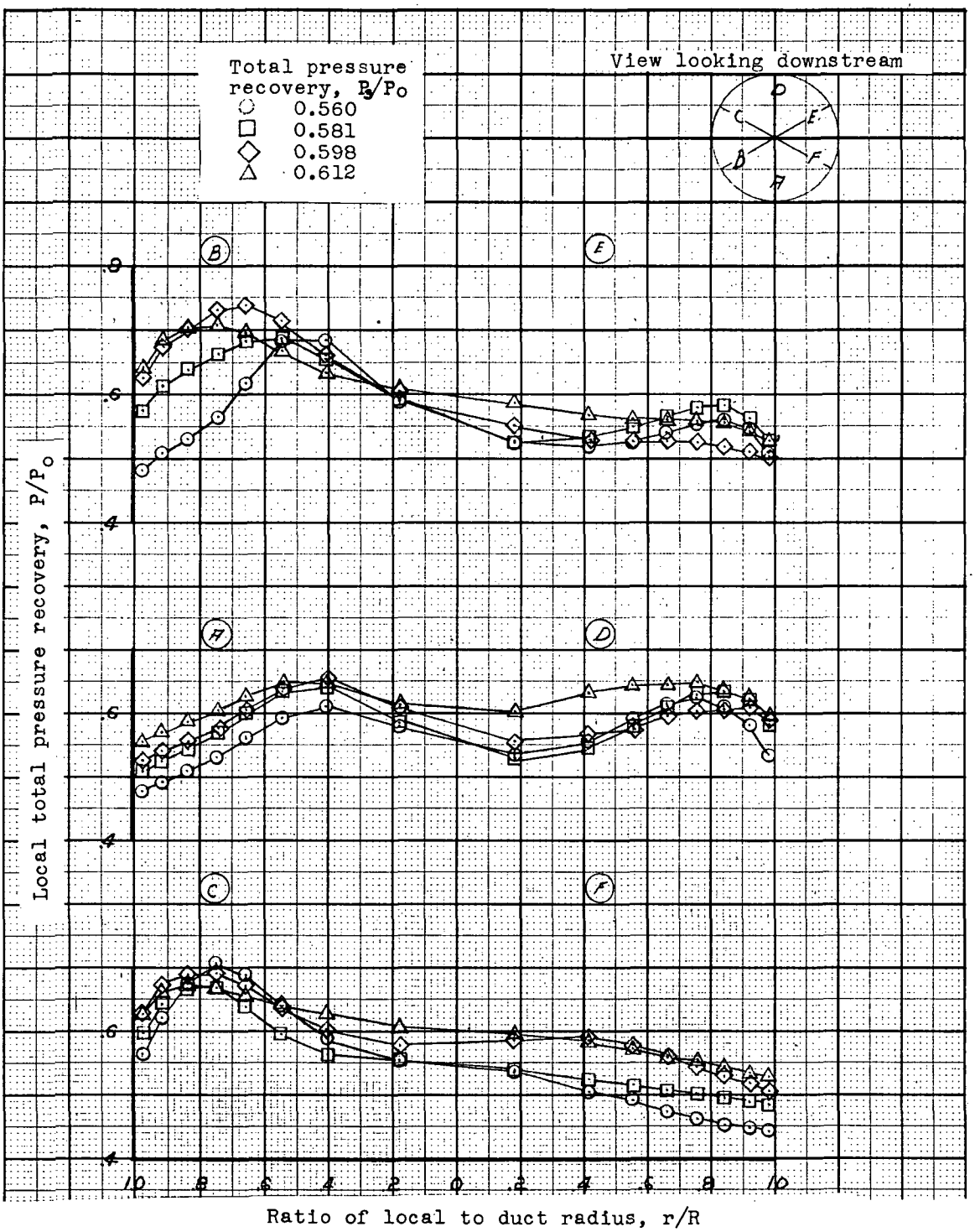
Figure 13. -Continued. Performance of diffuser D18C-55 vortex generator configuration.



(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

Figure 13. -Concluded. Performance of diffuser D18C-55 vortex generator configuration.

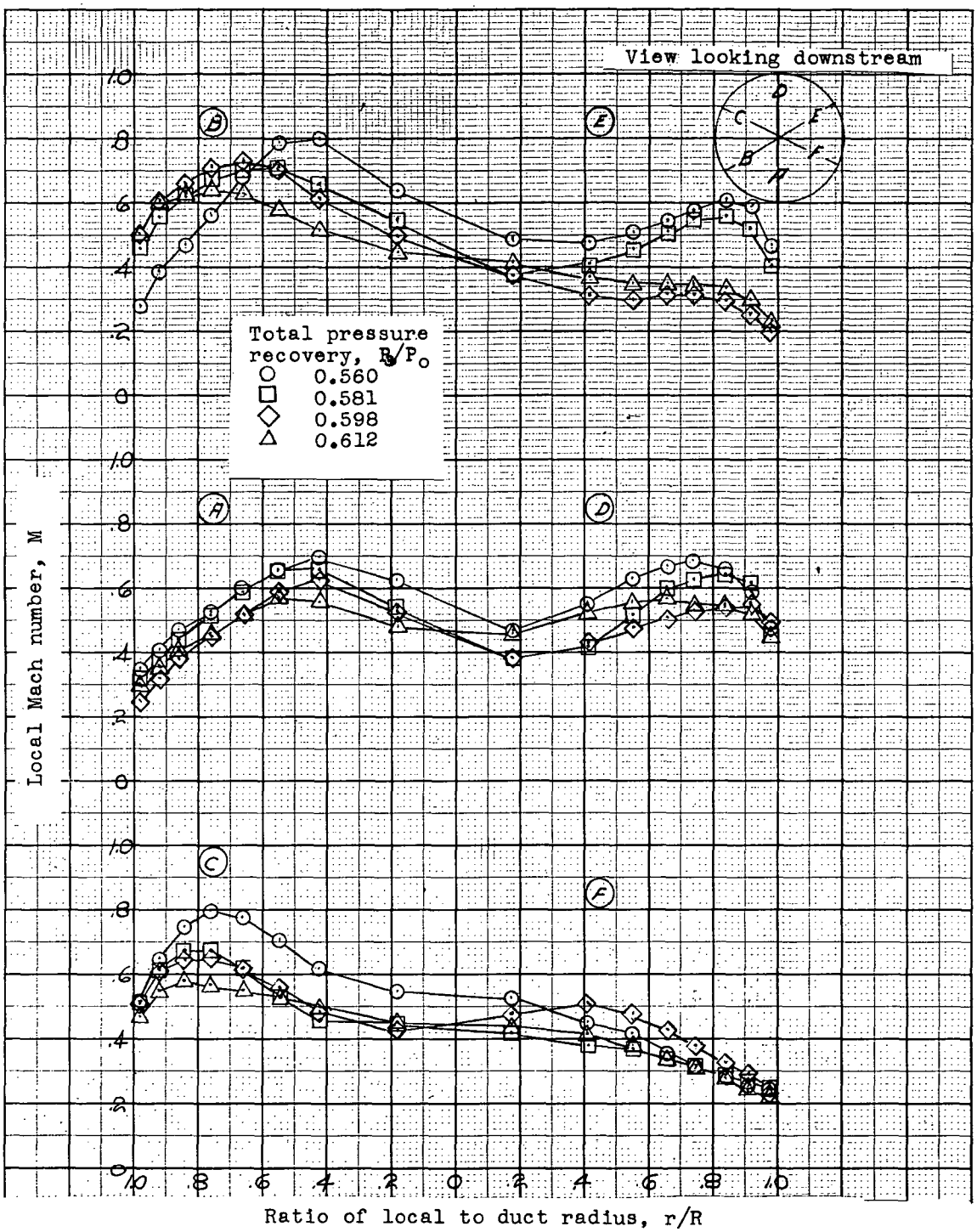
[redacted]



(a) Diffuser outlet pressure recovery profile.

Figure 14. Performance of diffuser D18C-55 vortex generator and full screen configuration.

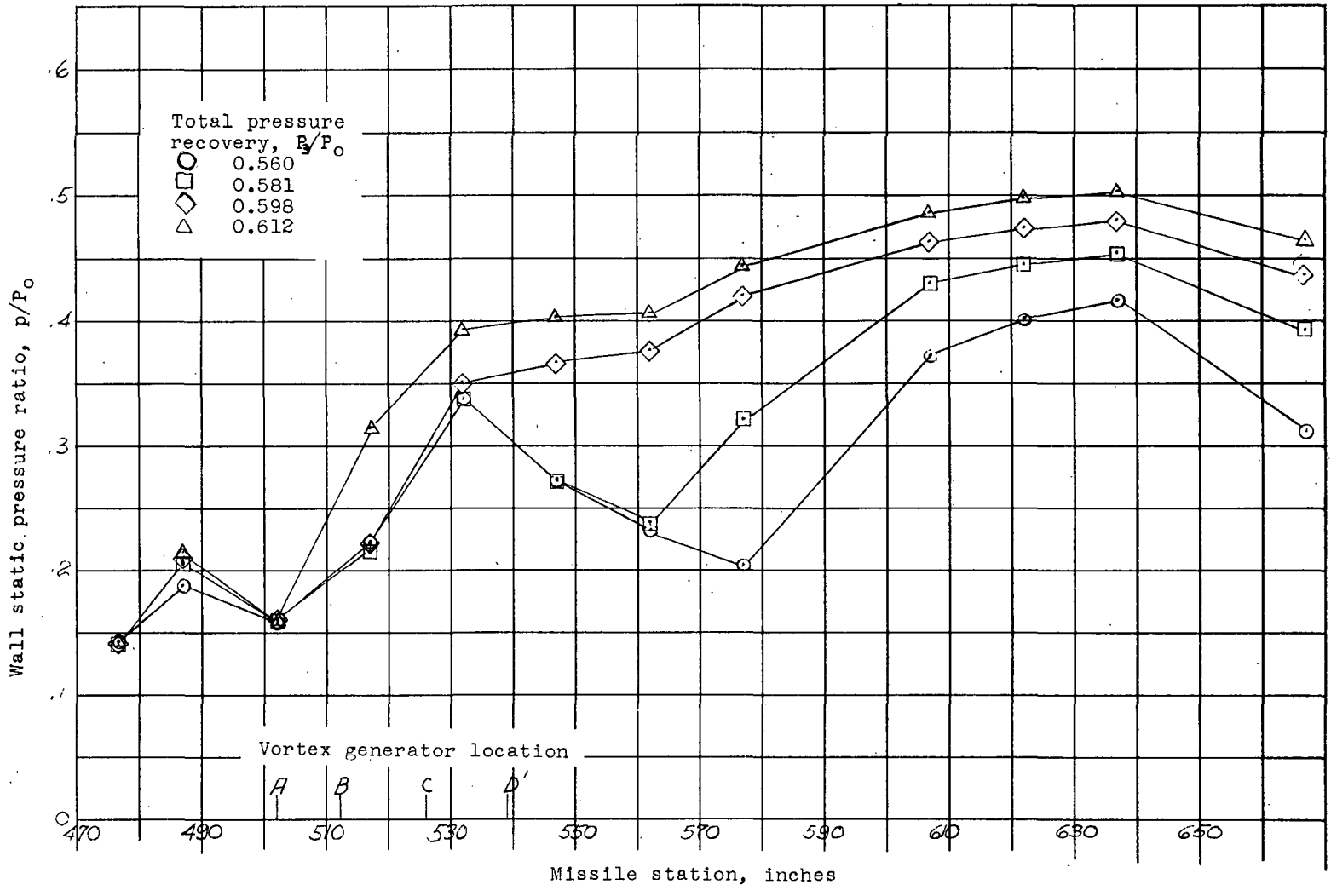
[redacted]



(b) Diffuser outlet Mach number profile.

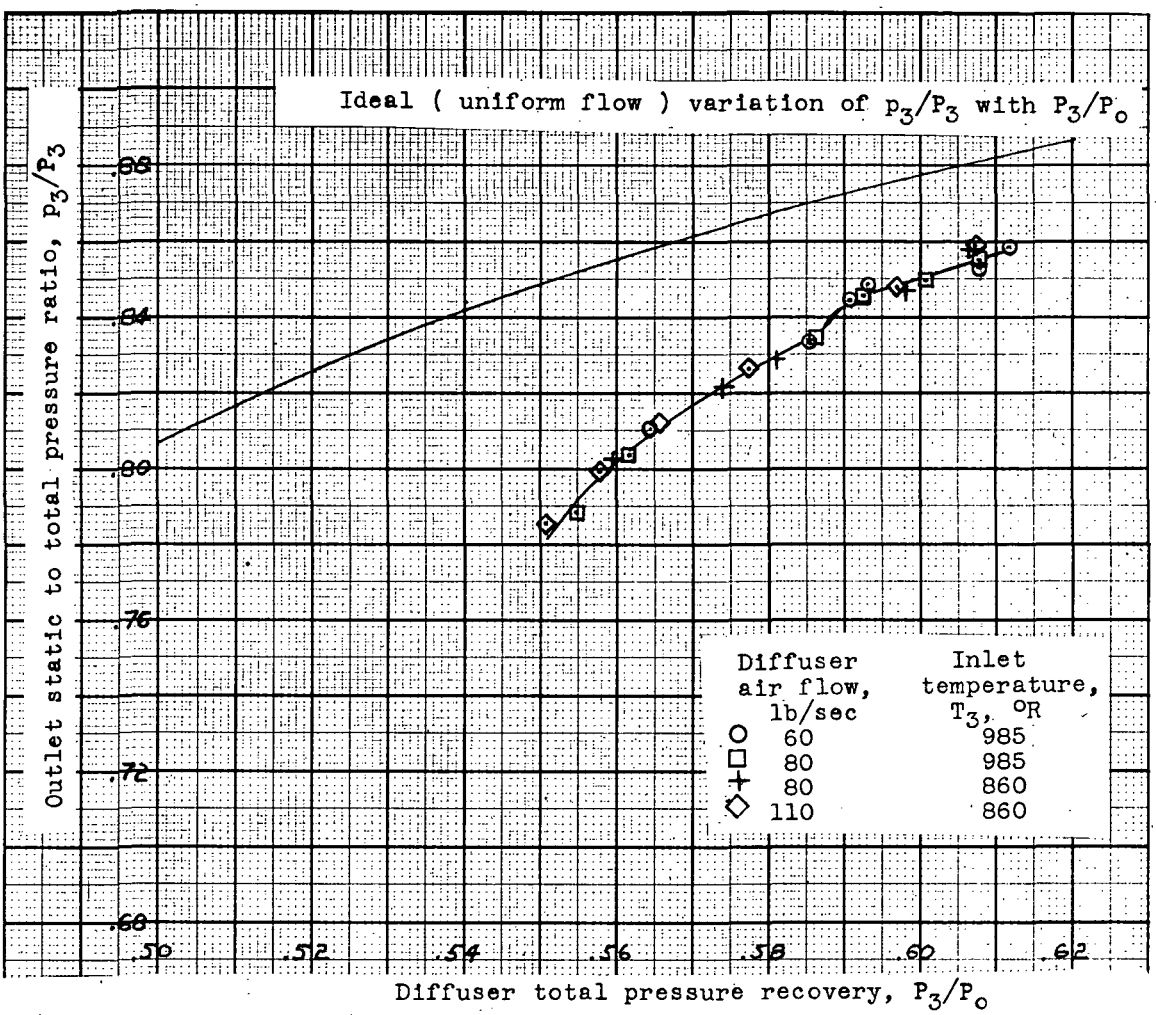
Figure 14. - Continued. Performance of diffuser D18C-55 vortex generator and full screen configuration.

[redacted]



(c) Longitudinal wall static pressure distribution.

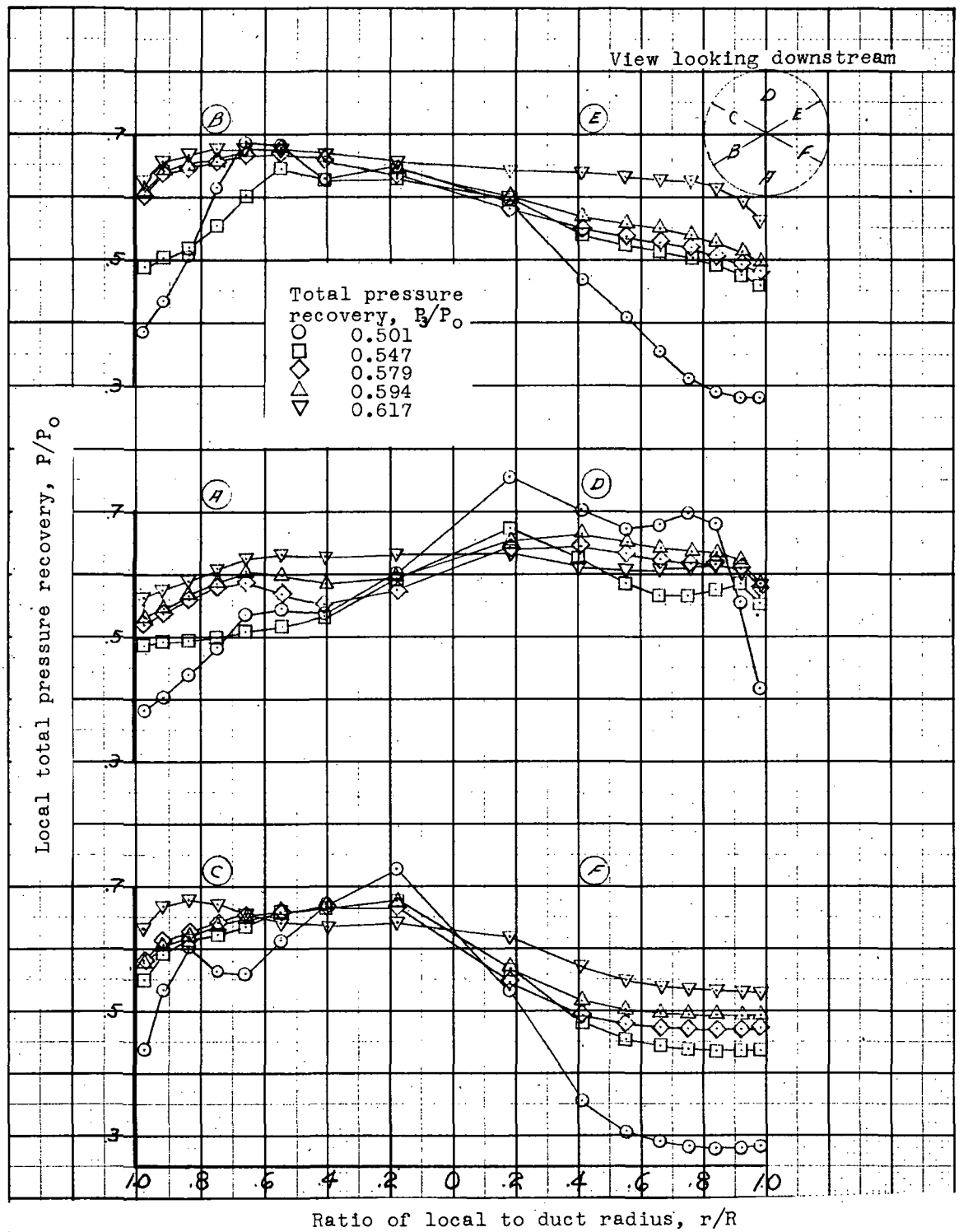
Figure 14.-Continued. Performance of diffuser D18C-55 vortex generator and full screen configuration.



(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

Figure 14.- Concluded. Performance of diffuser D18C-55 vortex generator and full screen configuration.

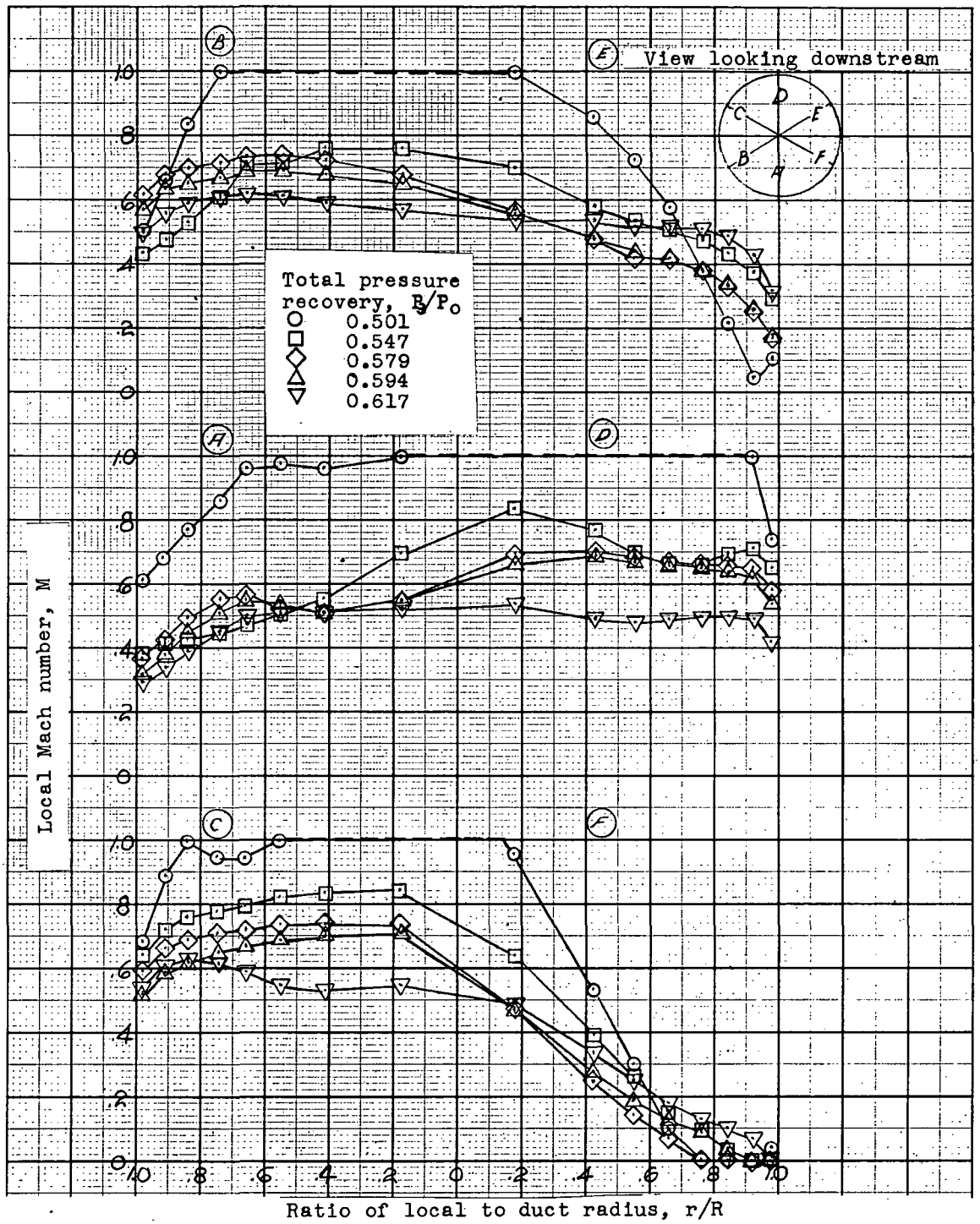
[redacted]



(a) Diffuser outlet pressure recovery profile.

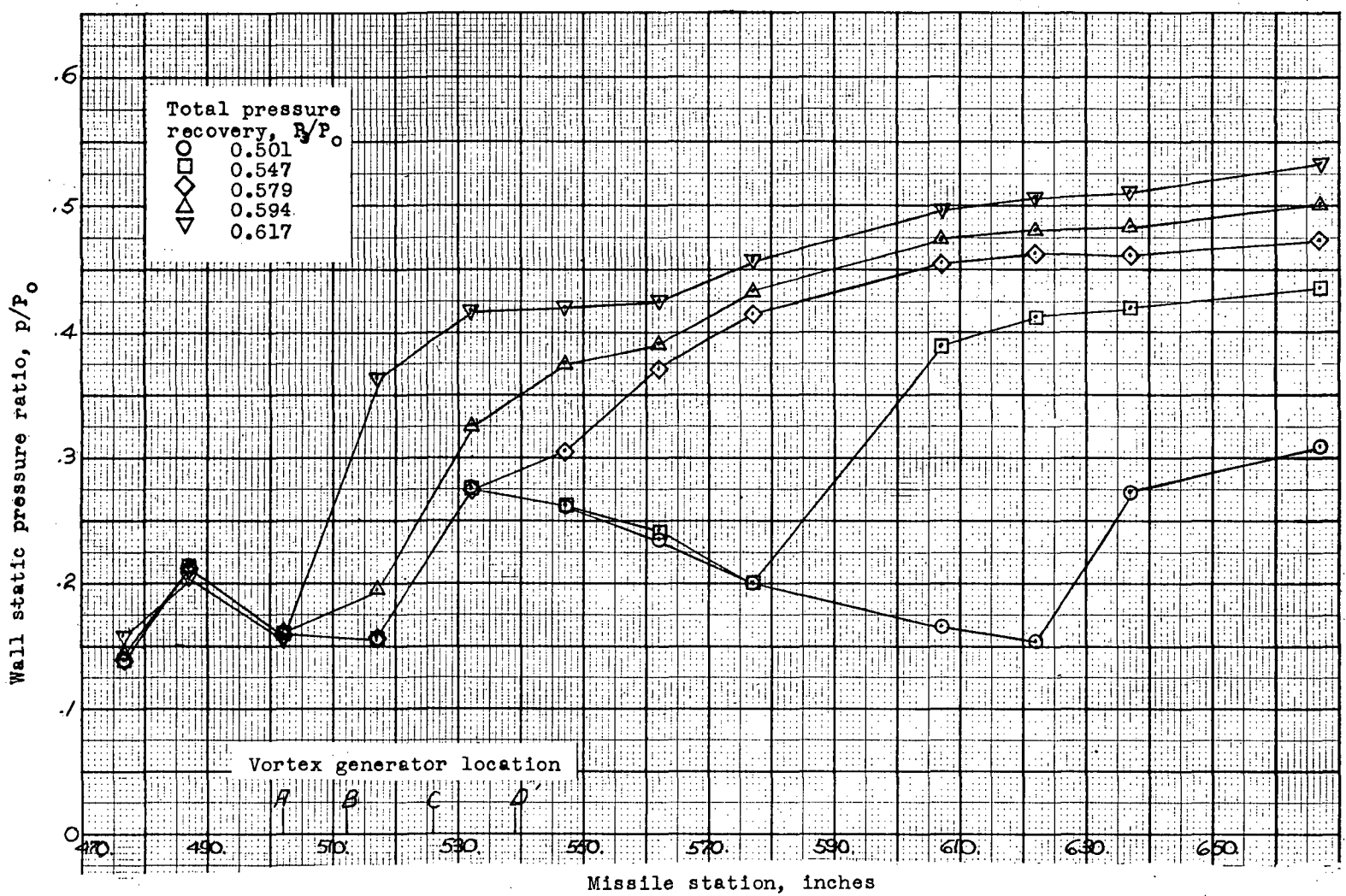
Figure 15. Performance of diffuser D18C-28 vortex generator configuration.

[redacted]



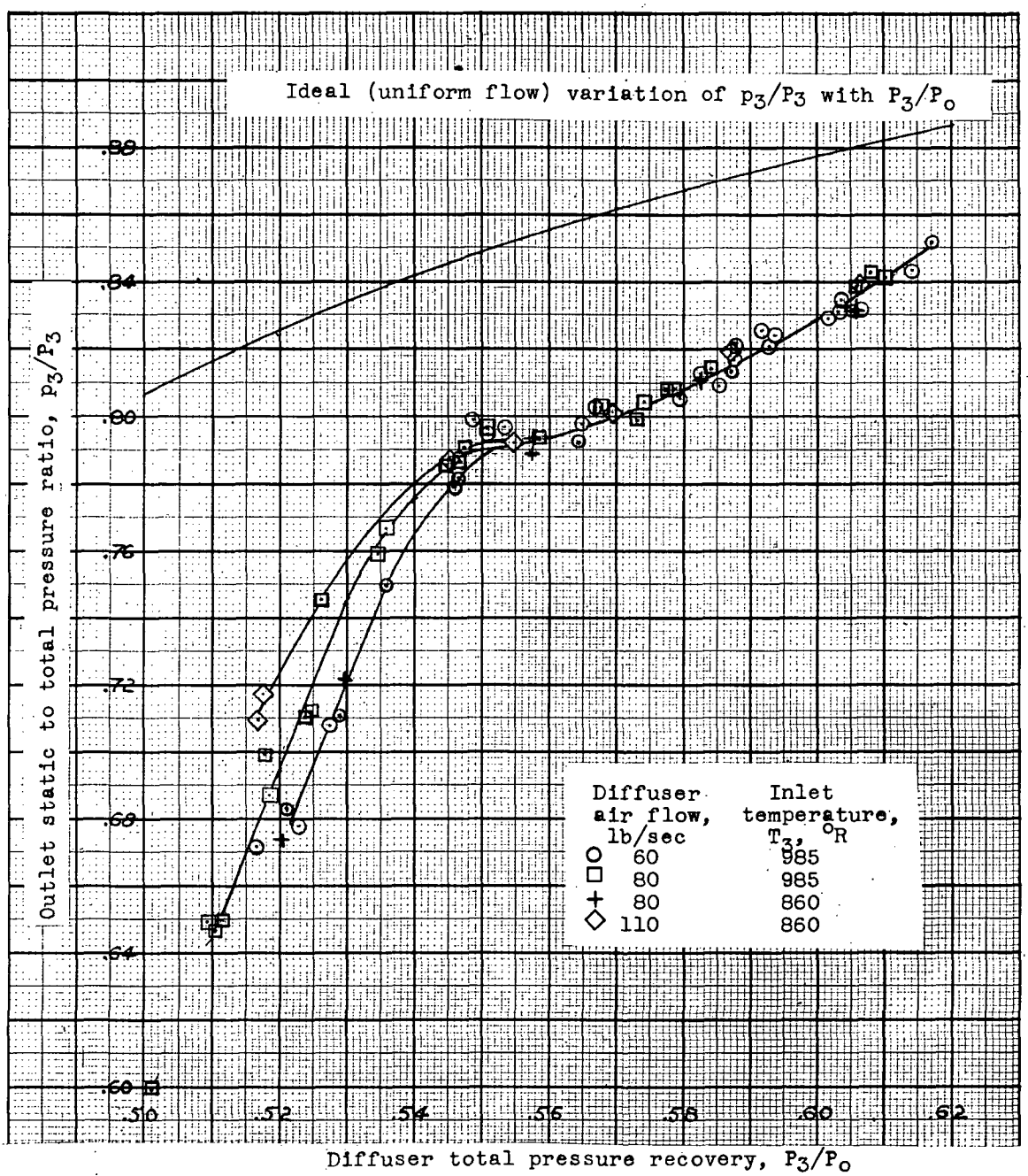
(b) Diffuser outlet Mach number profile.

Figure 15. -Continued. Performance of diffuser D18C-28 vortex generator configuration.



(c) Longitudinal wall static pressure distribution.

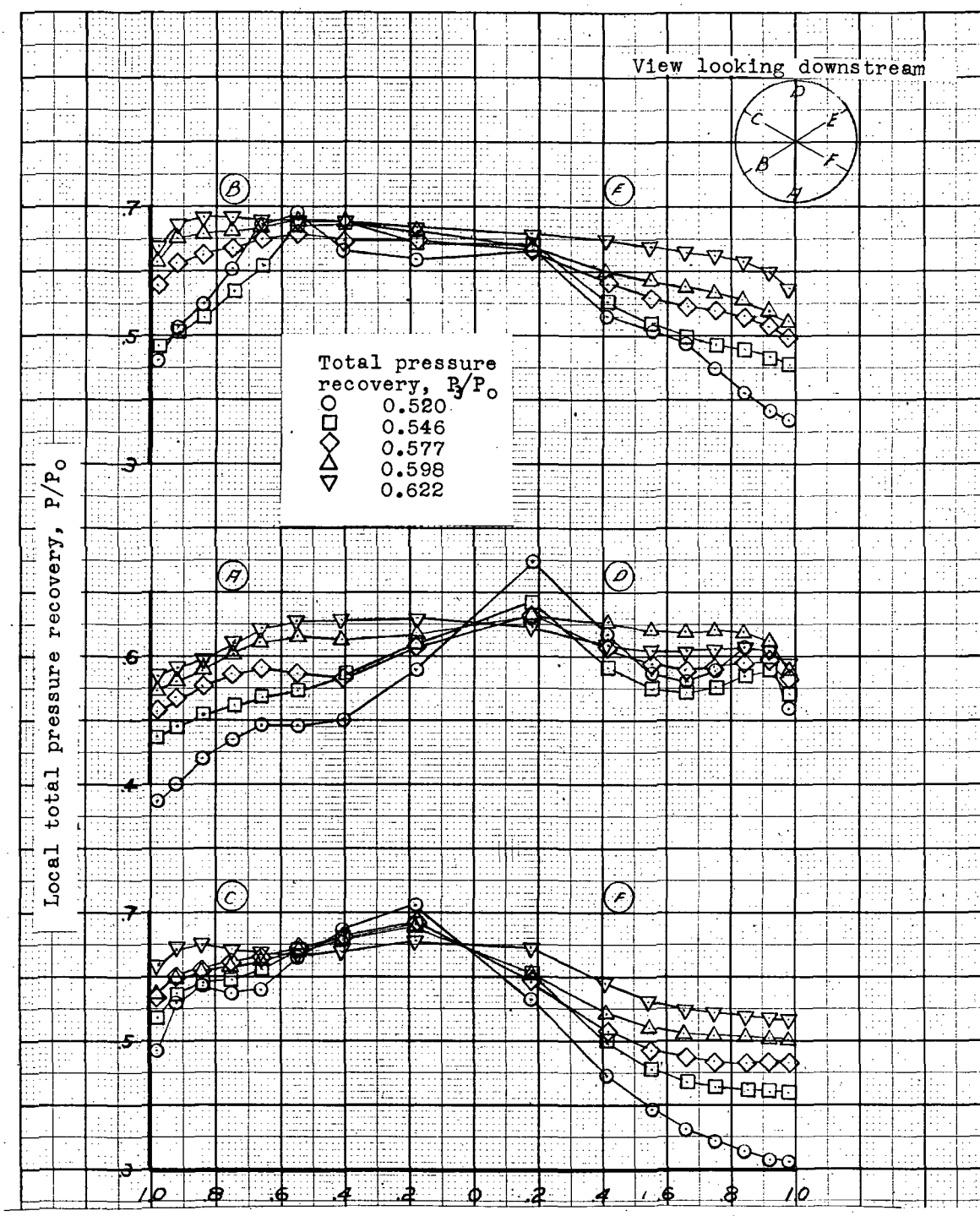
Figure 15. -Continued. Performance of diffuser D18C-28 vortex generator configuration.



(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

Figure 15.- Concluded. Performance of diffuser D18C-28 vortex generator configuration.

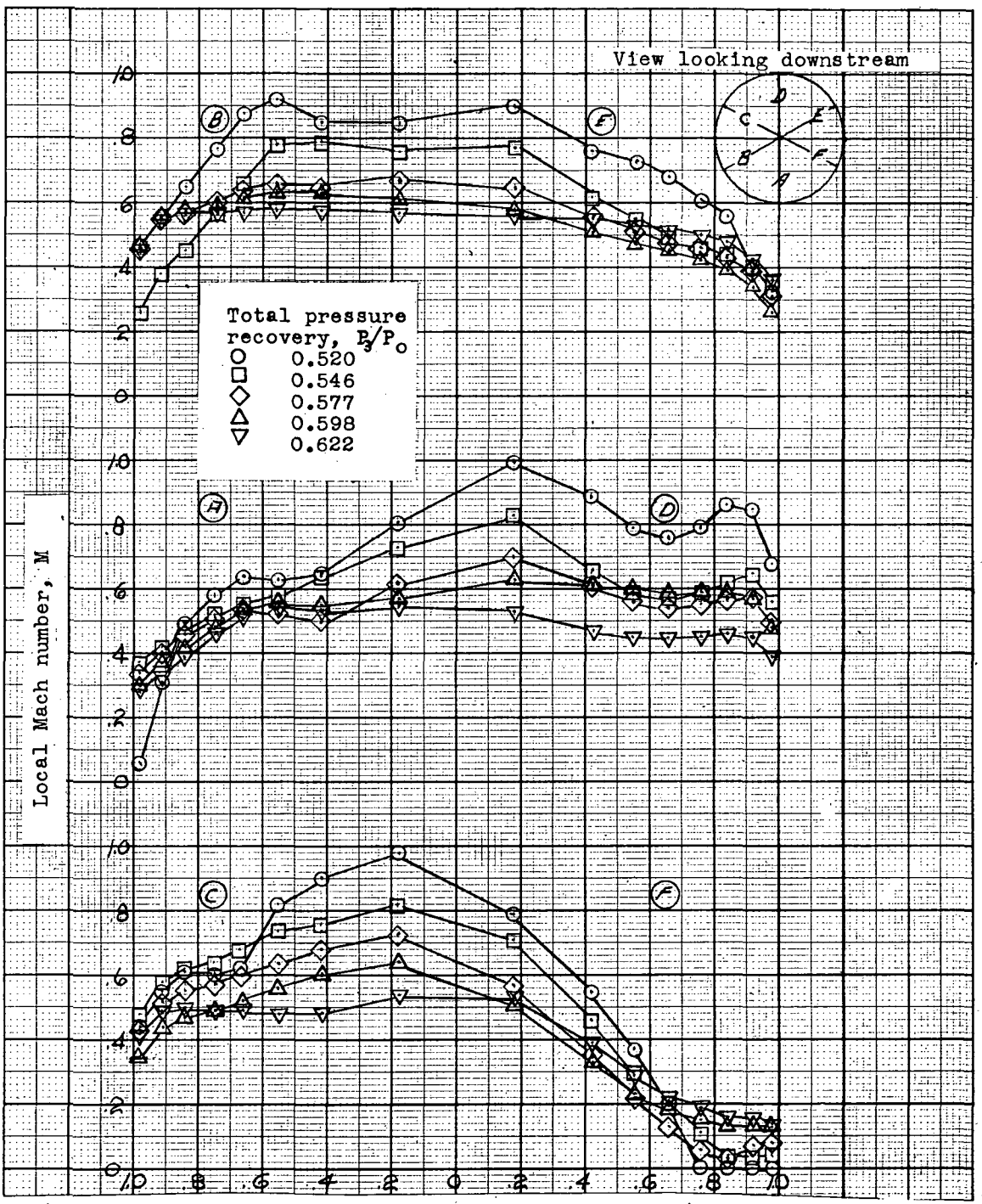
[redacted]



(a) Diffuser outlet pressure recovery profile.

Figure 16. Performance of diffuser D18C-28 vortex generator and half screen configuration.

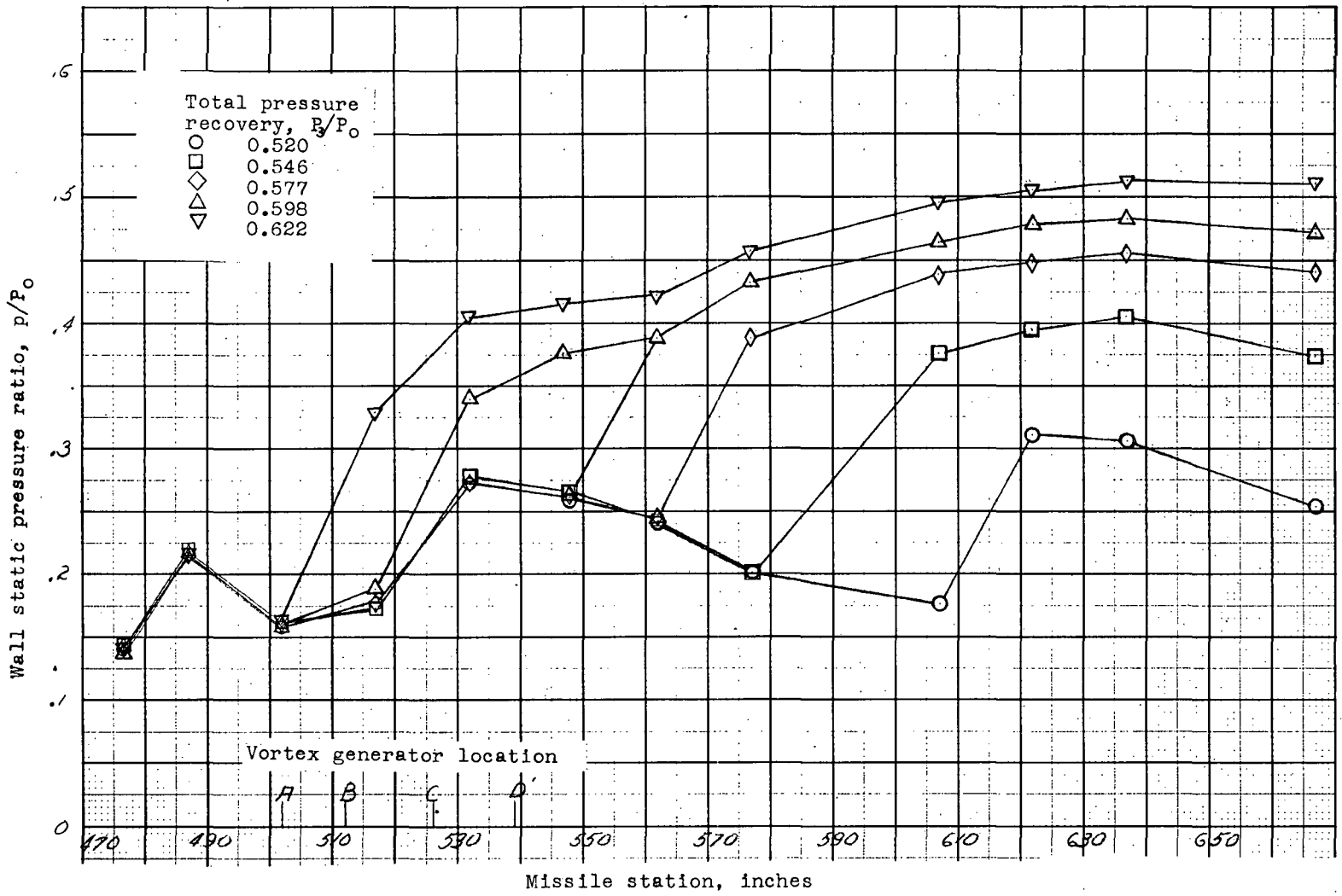
[redacted]



(b) Diffuser outlet Mach number profile.

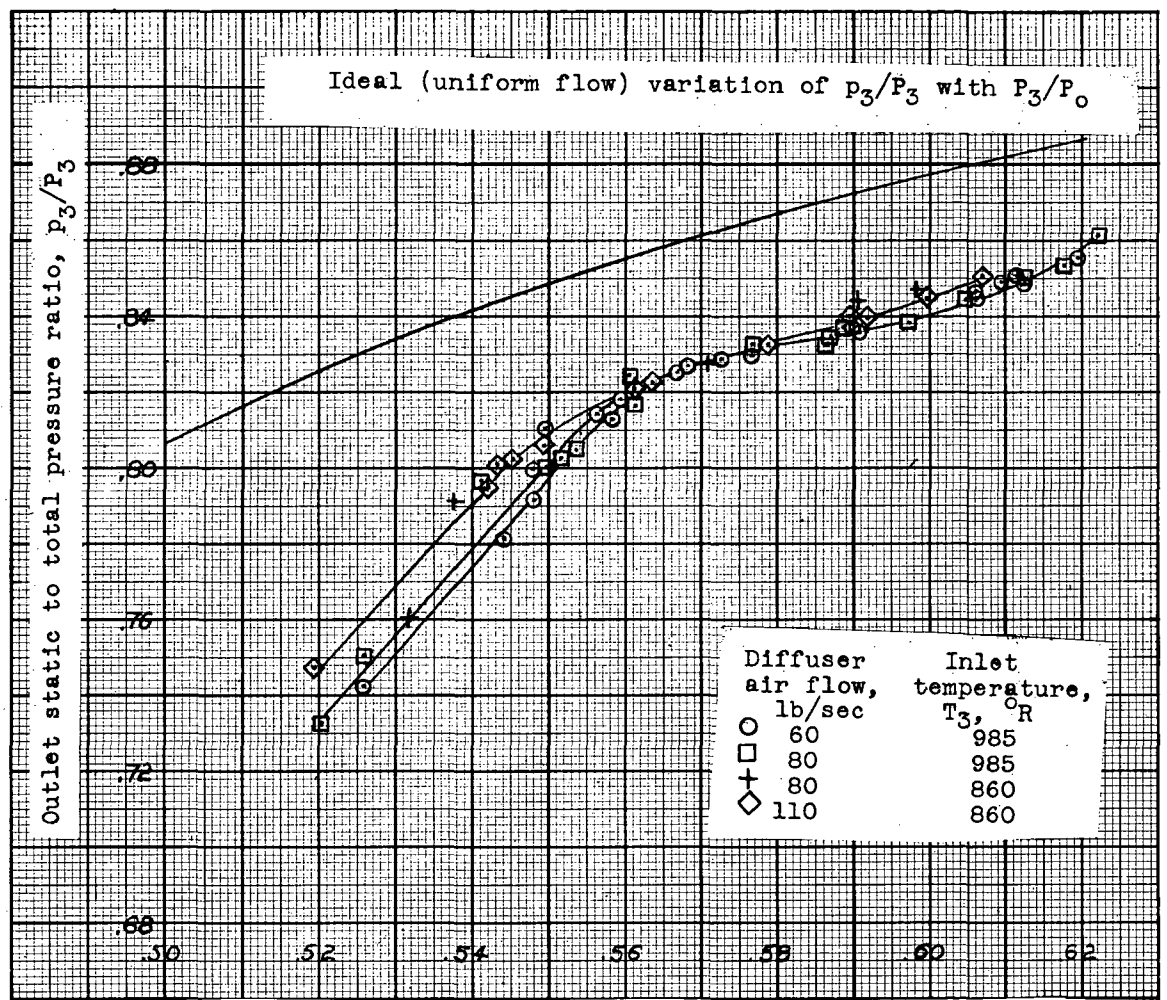
Figure 16. -Continued. Performance of diffuser D18C-28 vortex generator and half screen configuration.

[redacted]



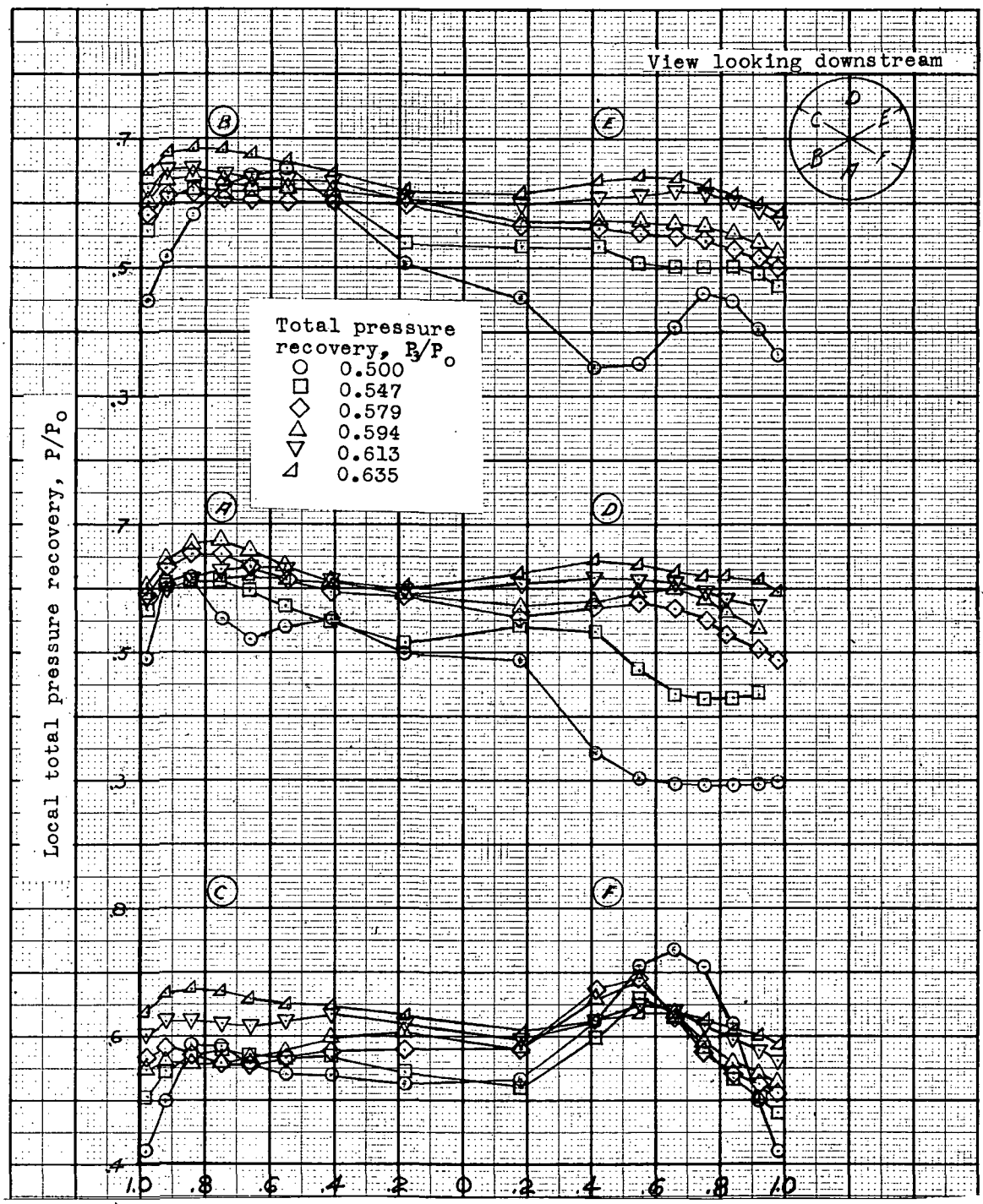
(c) Longitudinal wall static pressure distribution.

Figure 16. - Continued. Performance of diffuser D18C-28 vortex generator and half screen configuration.



(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

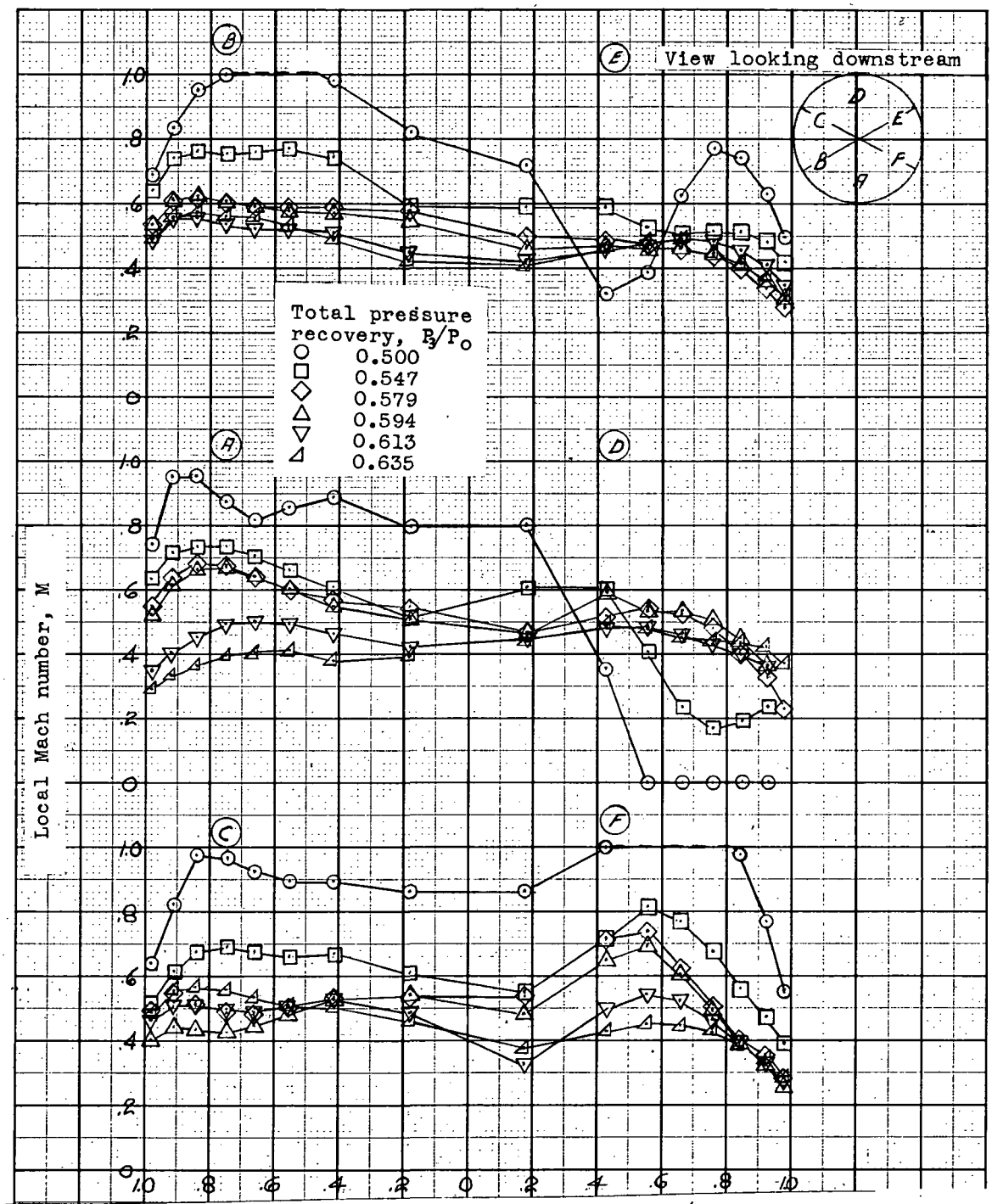
Figure 16. -Concluded. Performance of diffuser D18C-28 vortex generator and half screen configuration.



(a) Diffuser outlet pressure recovery profile.

Figure 17. Performance of diffuser D18C-116 vortex generator configuration.

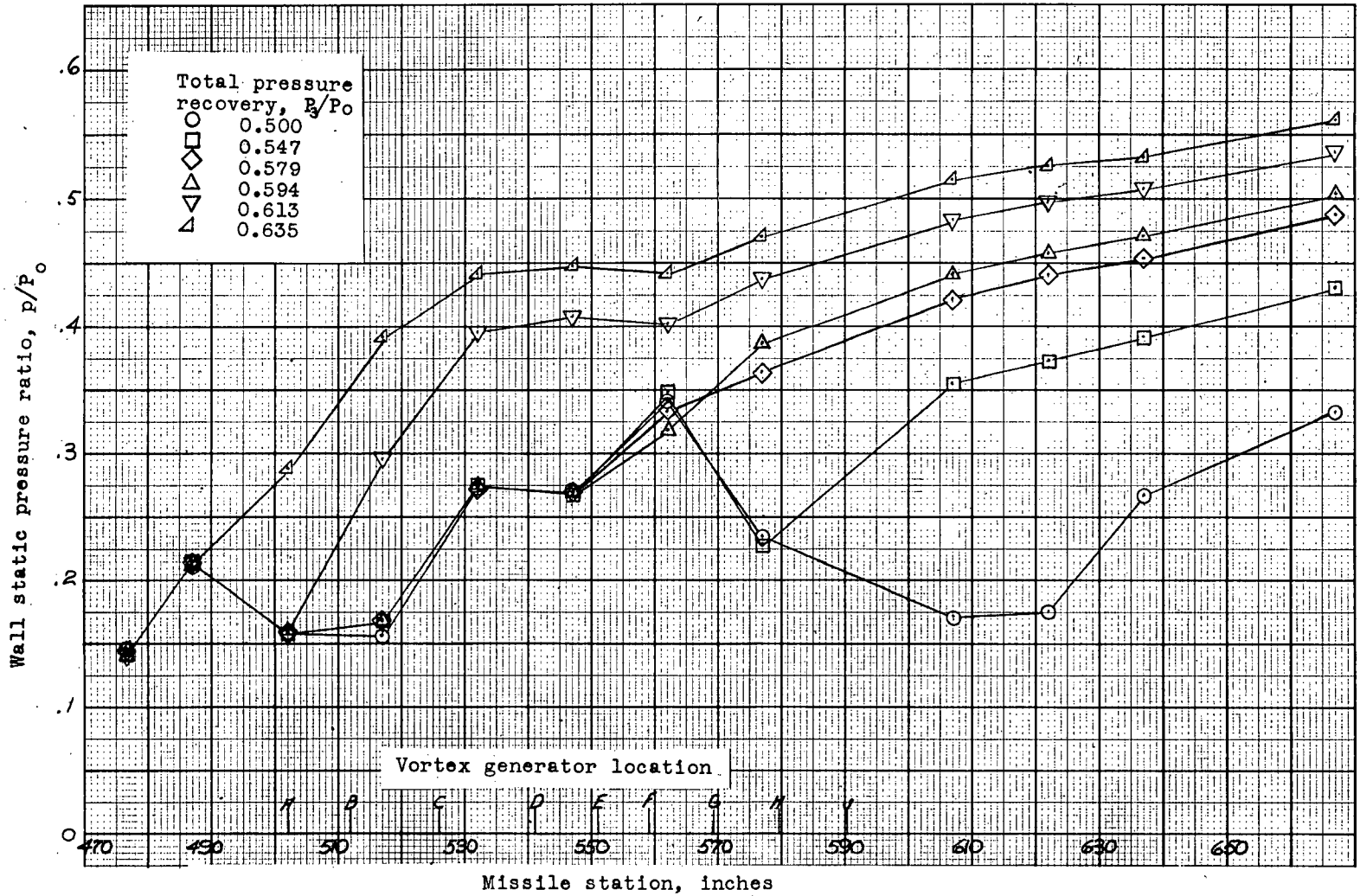
[redacted]



(b) Diffuser outlet Mach number profile.

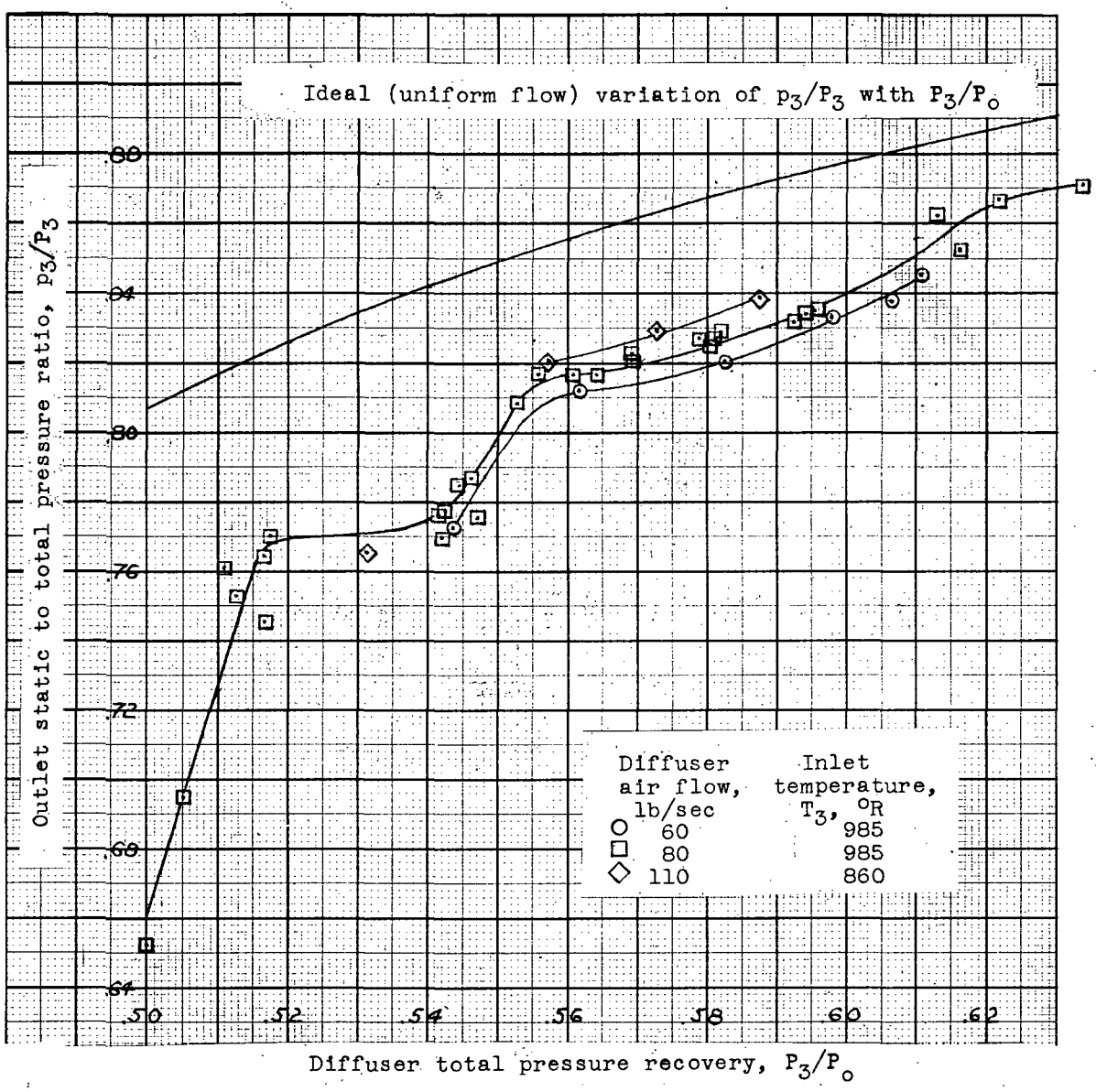
Figure 17.-Continued. Performance of diffuser D18C-116 vortex generator configuration.

[redacted]



(c) Longitudinal wall static pressure distribution.

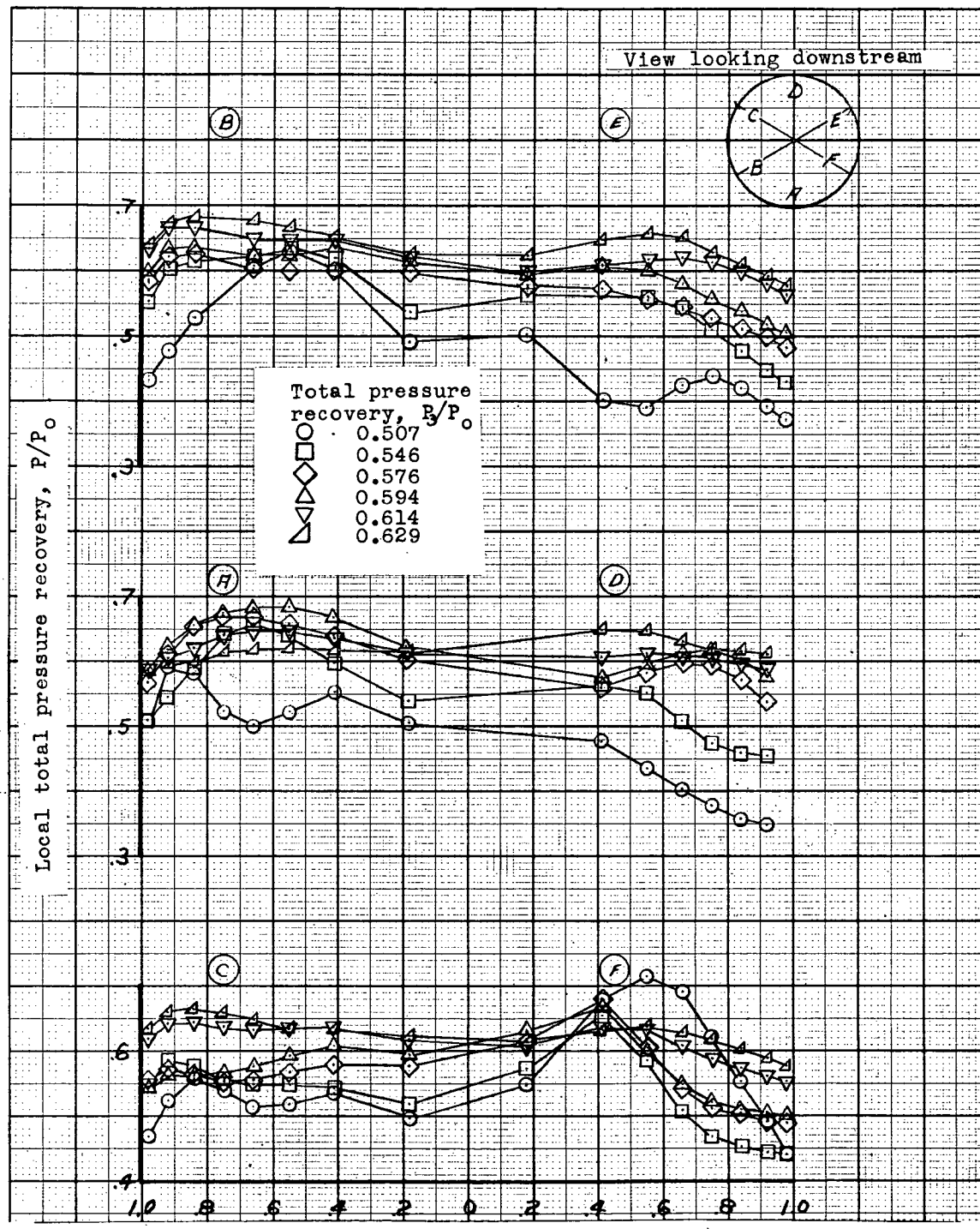
Figure 17. -Continued. Performance of diffuser D18C-116 vortex generator configuration.



(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

Figure 17. -Concluded. Performance of diffuser D18C-116 vortex generator configuration.

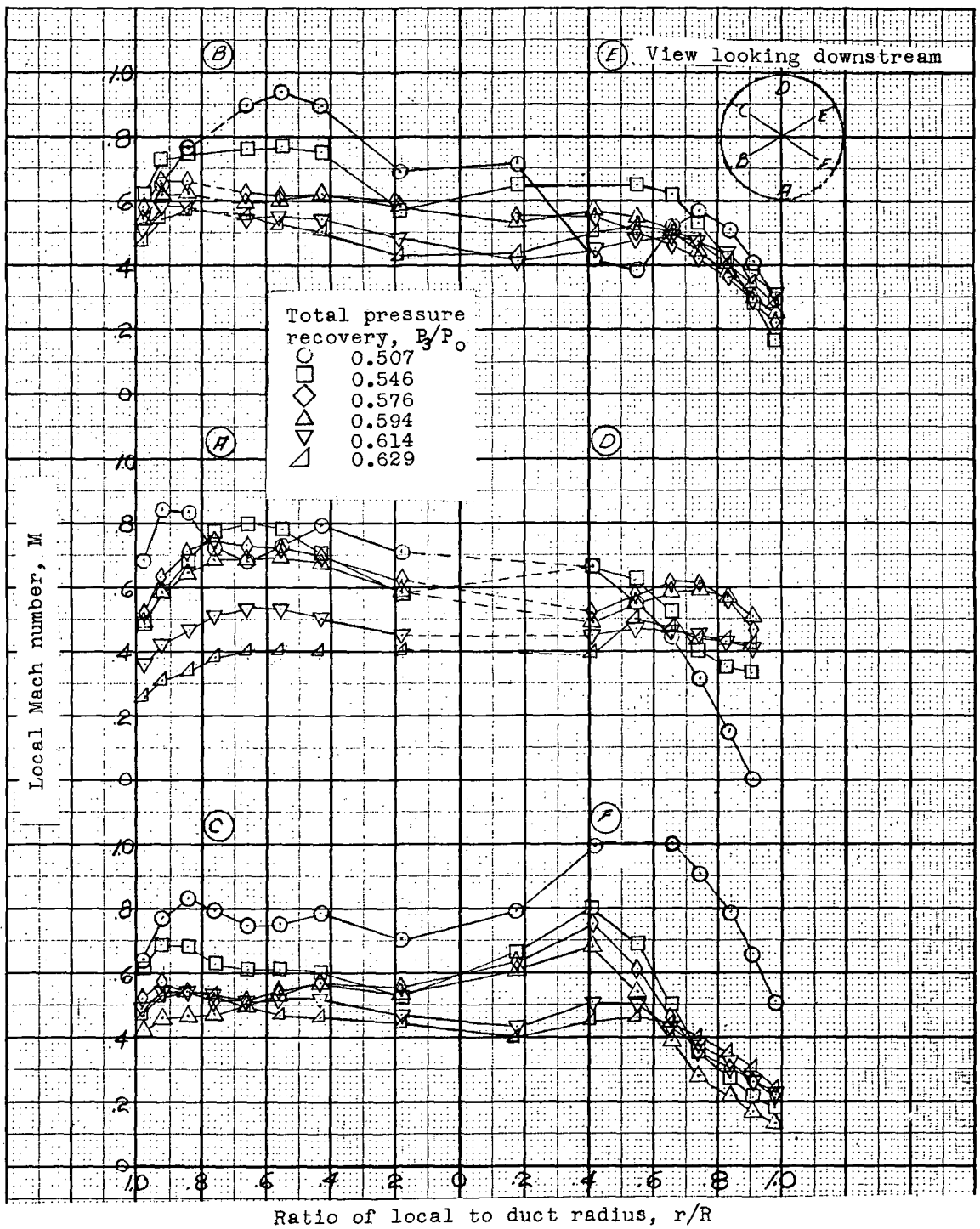
[redacted]



(a) Diffuser outlet pressure recovery profile.

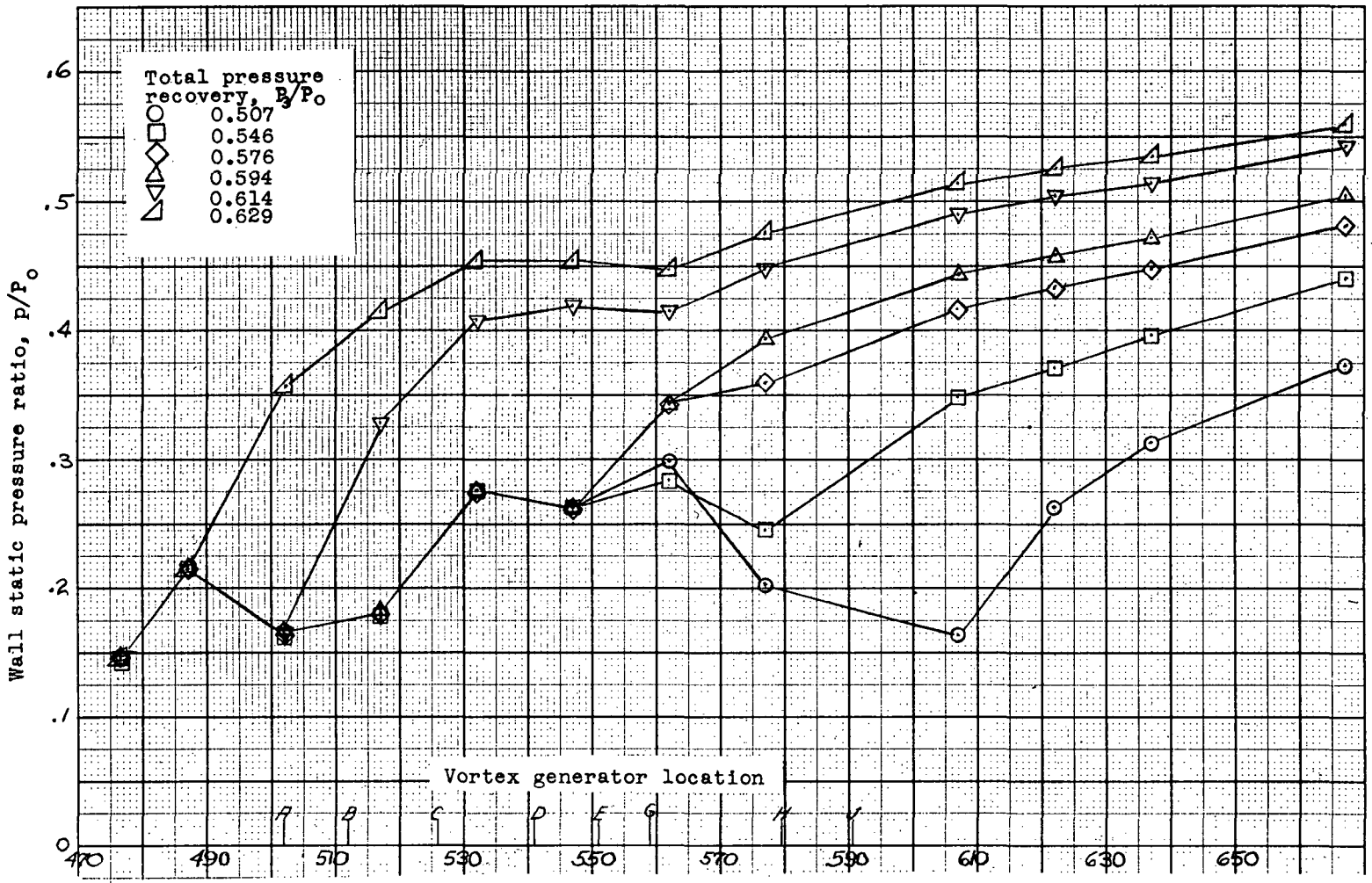
Figure 18. Performance of diffuser D18C-116A vortex generator configuration.

[redacted]



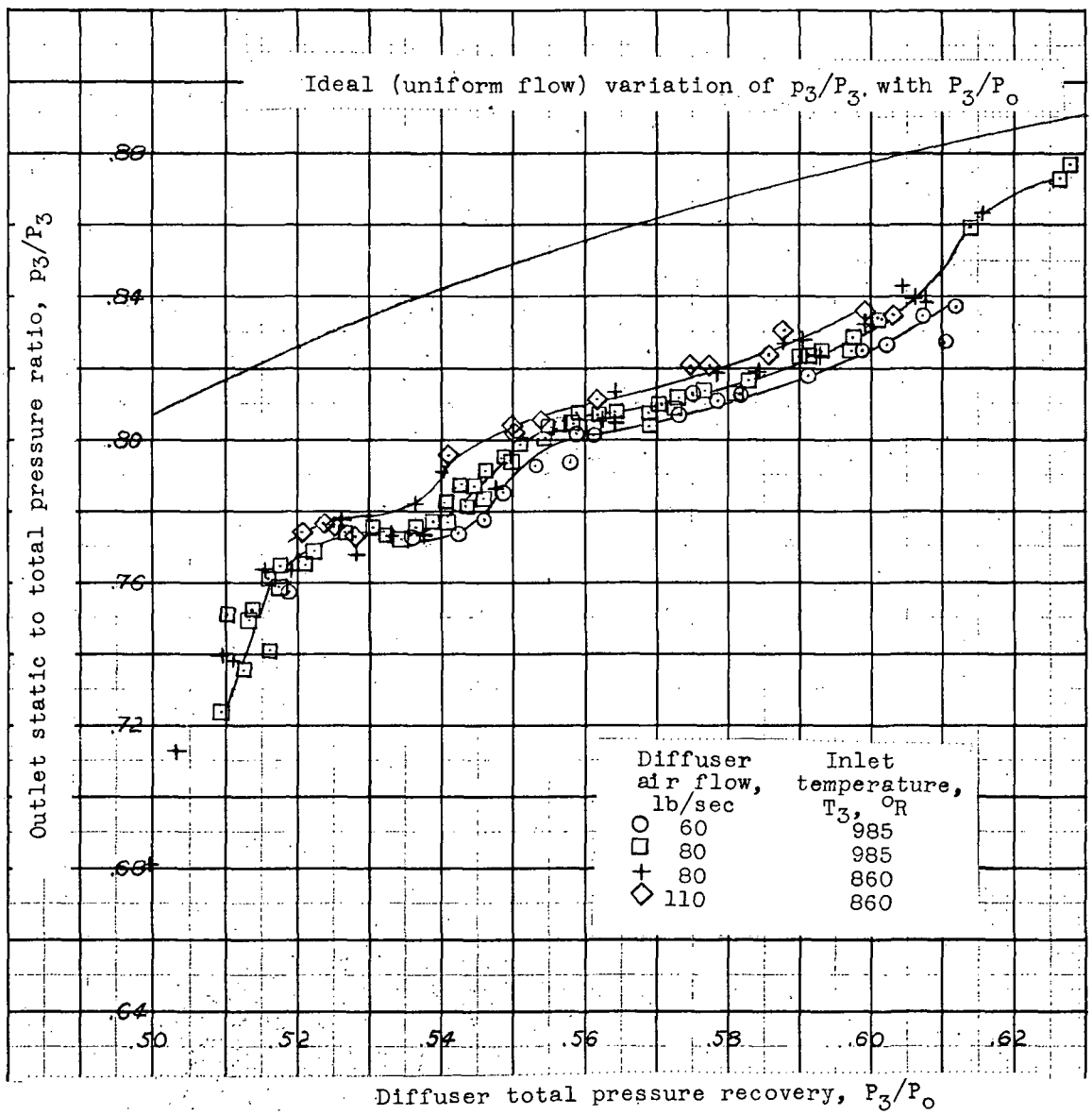
(b) Diffuser outlet Mach number profile.

Figure 18. -Continued. Performance of diffuser D18C-116A vortex generator configuration.



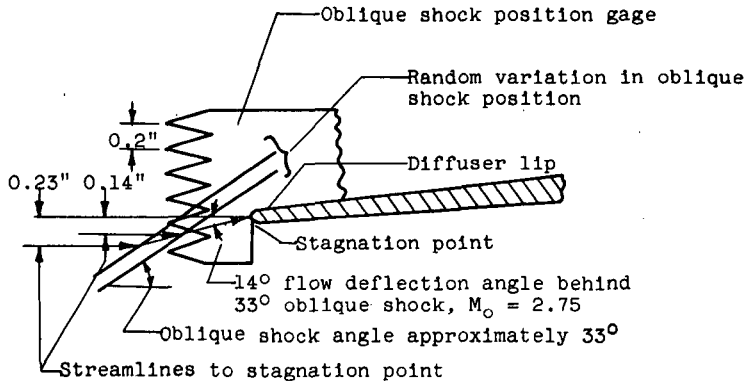
(c) Longitudinal wall static pressure distribution.

Figure 18. -Continued. Performance of diffuser D18C-116A vortex generator configuration.

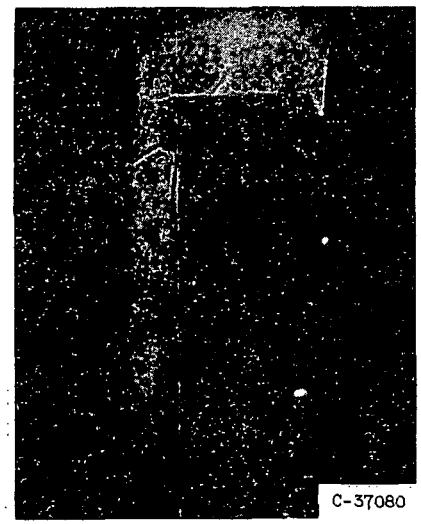


(d) Variation of diffuser static to total pressure ratio with diffuser total pressure recovery.

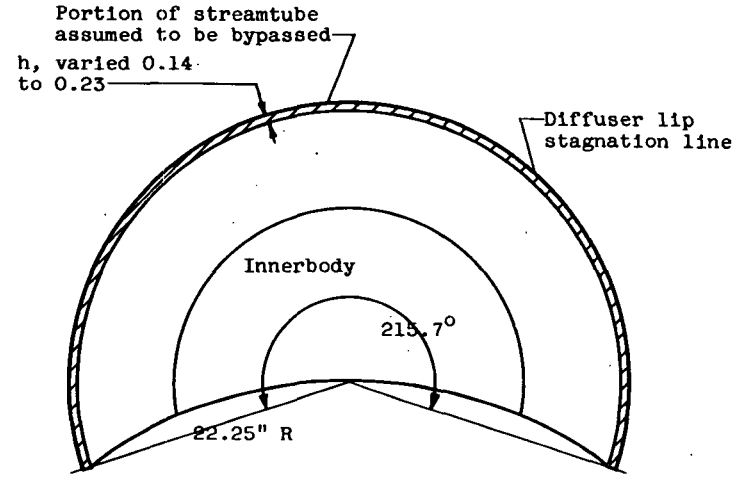
Figure 18. -Concluded. Performance of diffuser D18C-116A vortex generator configuration.



(b) Side view showing oblique shock position.



(a) Typical shadowgraph photograph.



(c) Cross section at diffuser lip.

Calculations

1. Oblique shock position varied within range shown in figure (b). With this range of shock positions, the height of the annulus of bypassed air varied from about 0.14 to 0.23 in. This annulus height was determined graphically using the theoretical flow deflection (14°) behind the oblique shock wave (approx. 33°) for an inlet Mach number of 2.75.

2. It is assumed that spillage is symmetrical around the 215.7° annular segment. Figure (c).

3. The inlet capture area is 6.15 sq ft (within heavy lines on Figure (c)).

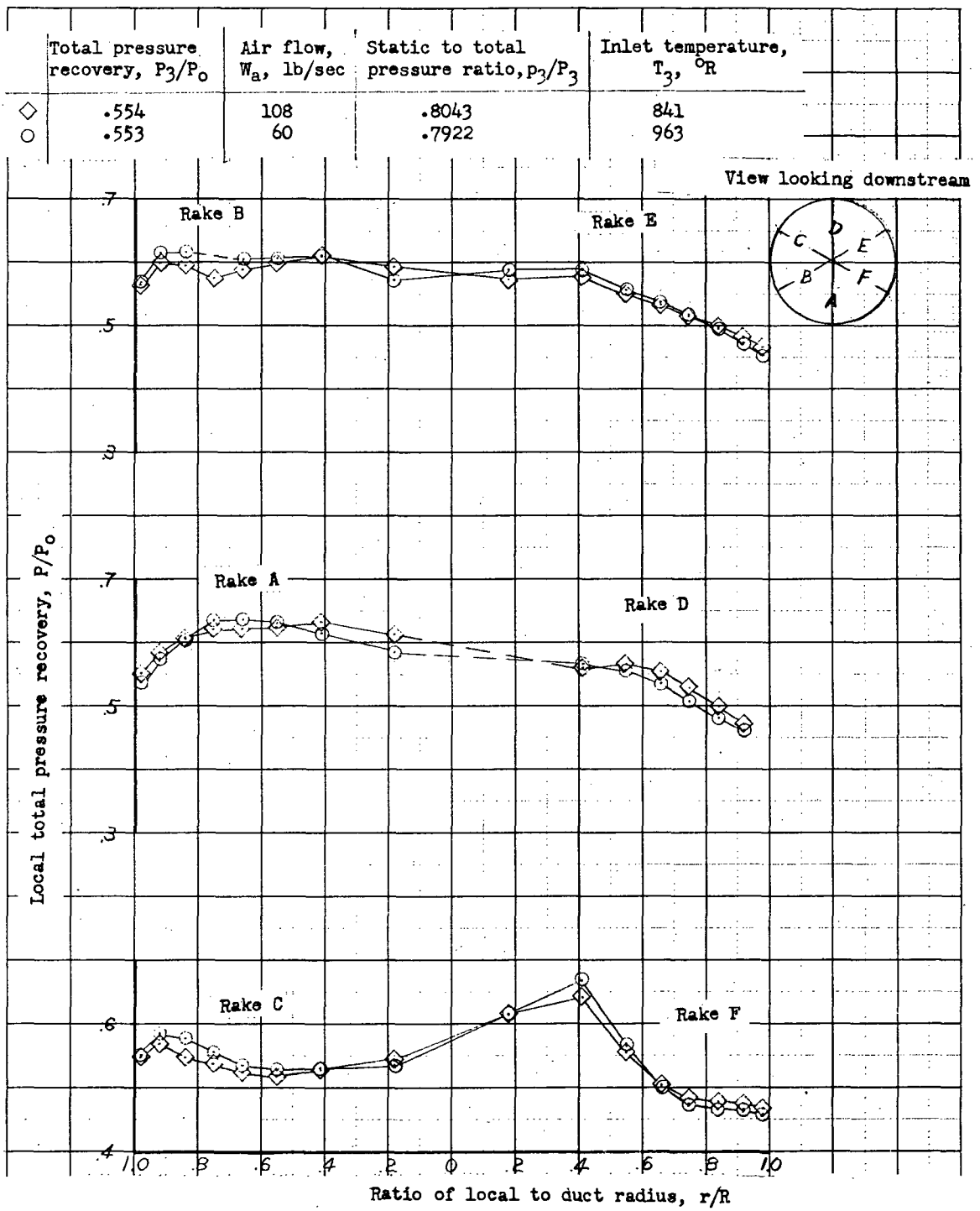
4. Then:

$$\text{Inlet capture area ratio, } C_{D_o}, = 1 - \frac{\left(\frac{215.7}{360}\right)\left(\frac{\pi}{144}\right)(44.5)h}{6.15}$$

$$C_{D_o} = 1 - 0.0946h$$

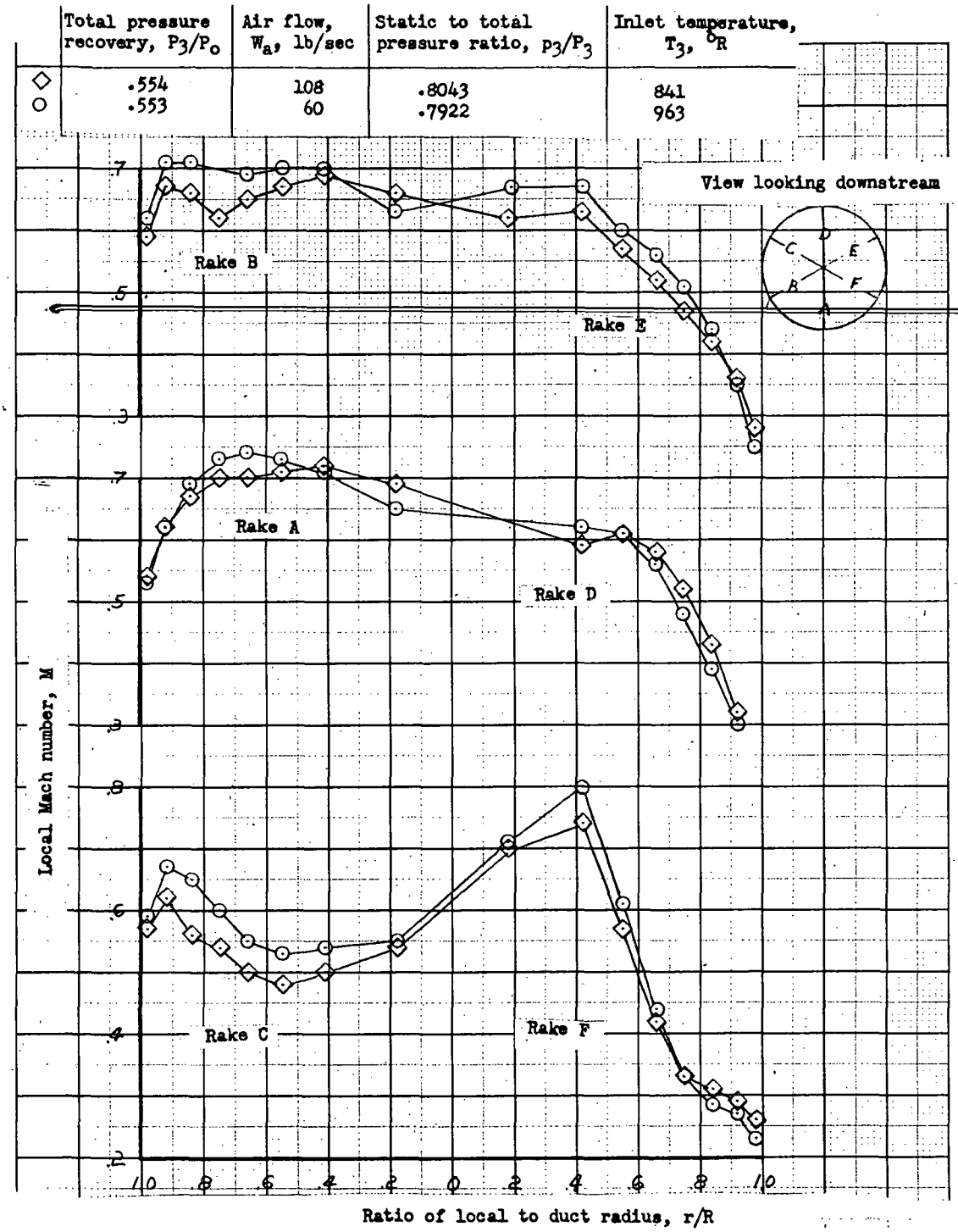
But, $0.14 \leq h \leq 0.23$, then C_{D_o} is between 0.987 and 0.978.

Figure 19. - Determination of diffuser capture area ratio from oblique shock position.



(a) Diffuser outlet pressure recovery profile.

Figure 20. - Effect of inlet conditions on diffuser outlet flow profile. Diffuser D18C-116A vortex generator configuration.



(b) Diffuser outlet Mach number profile.

Figure 20. -Concluded. Effect of inlet conditions on diffuser outlet flow profile. Diffuser D18C-116A vortex generator configuration.

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NACA RM SE54J22

PRELIMINARY PERFORMANCE DATA OBTAINED IN A FULL-SCALE FREE-JET INVESTIGATION OF A SIDE-INLET SUPERSONIC DIFFUSER

John M. Farley
John M. Farley
Aeronautical Research Scientist
Propulsion Systems

Ivan D. Smith
Ivan D. Smith
Aeronautical Research Scientist
Propulsion Systems

Approved:

H. Dean Wilsted
H. Dean Wilsted
Aeronautical Research Scientist
Propulsion Systems

Bruce T. Lundin
Bruce T. Lundin
Chief
Engine Research Division

hjk - 10/29/54

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